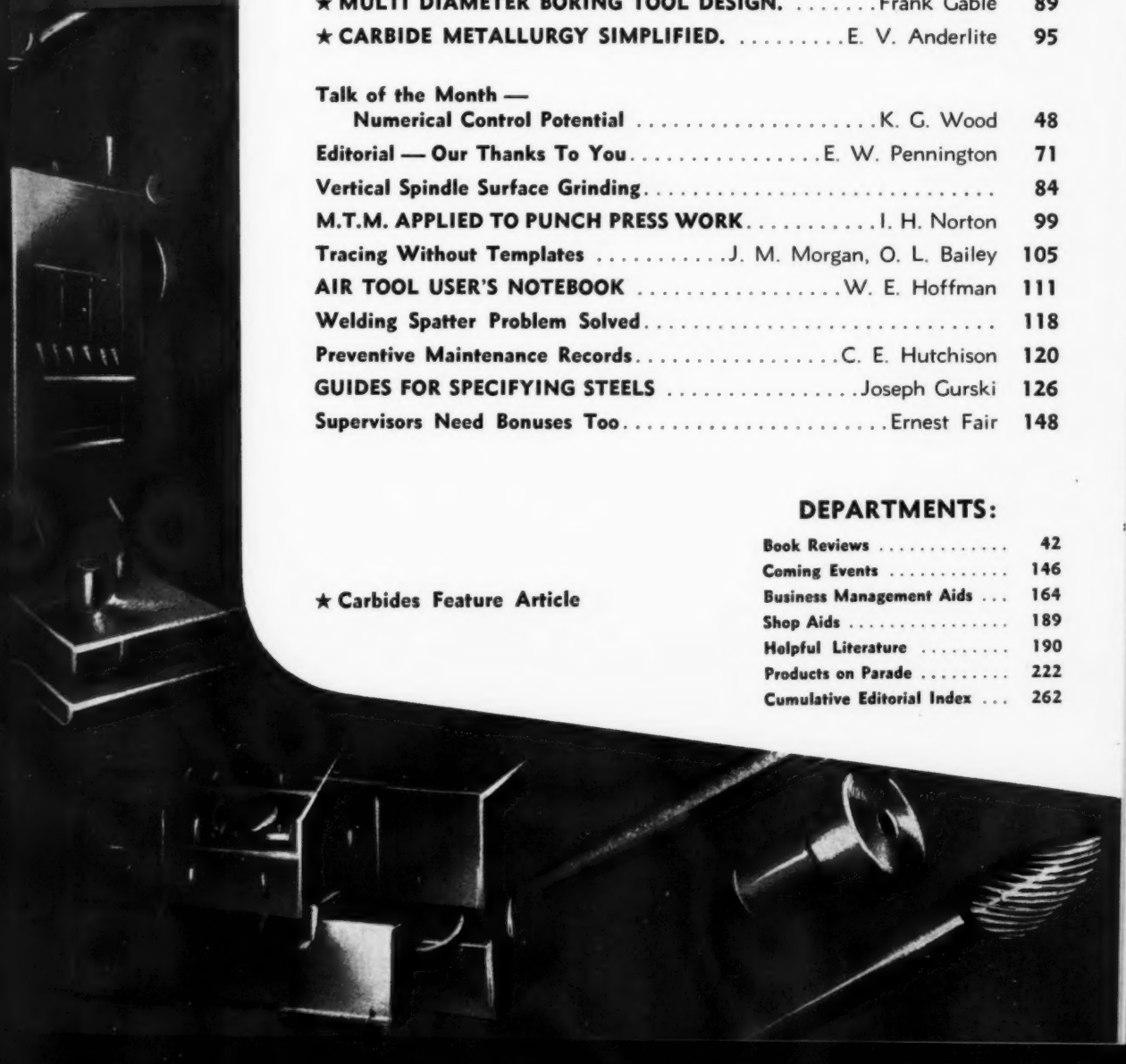
TOOLING & PRODUCTION

Magazine

BRUARY 1957



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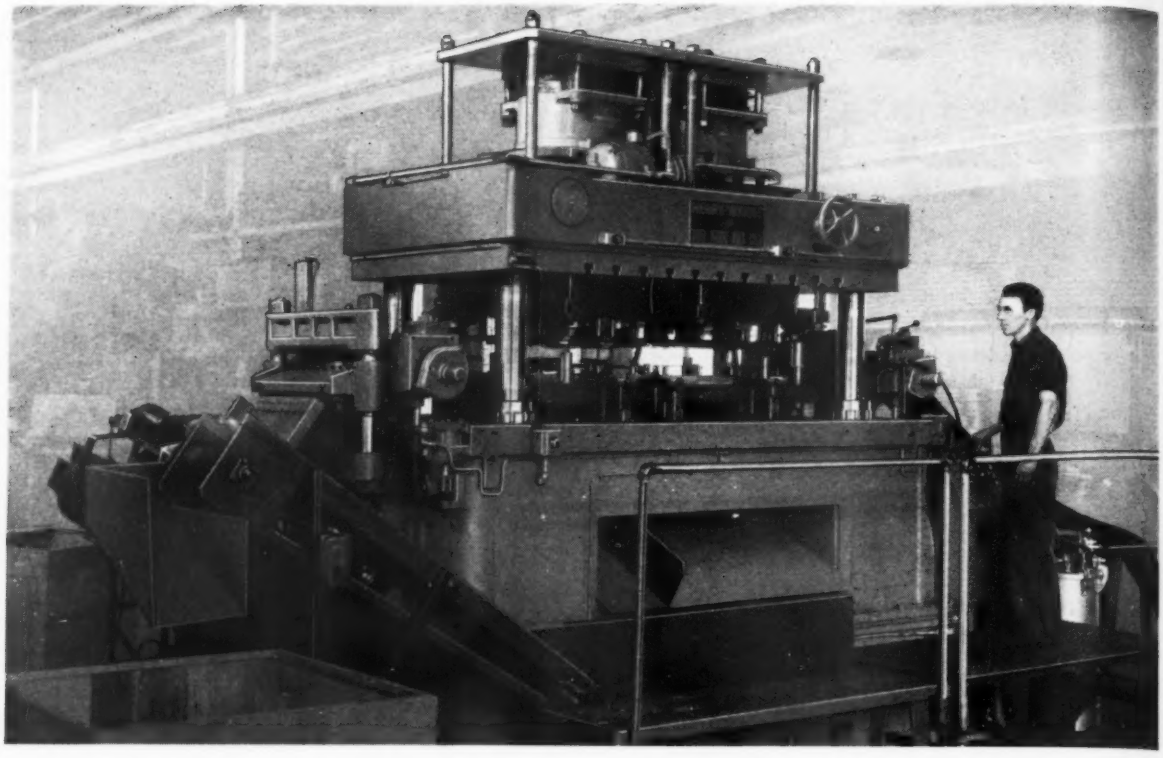


Henry & Wright Double Crank

"definitely improved our competitive position"

TO KEEP PACE with trends in progressive stamping, Grand Haven Stamped Products Co., Grand Haven, Mich., bought a 100-ton Single Crank Henry & Wright in 1954. Its performance was so impressive, Grand Haven purchased a 200-ton Double Crank in 1956.

ON VERY FIRST JOB the new machine equalled expectations. The part involved — an automotive vent grill — is produced two at a time on a multi-station die from a 15⅝" strip of 22-gauge, cold-rolled steel, at 124 pieces per minute.

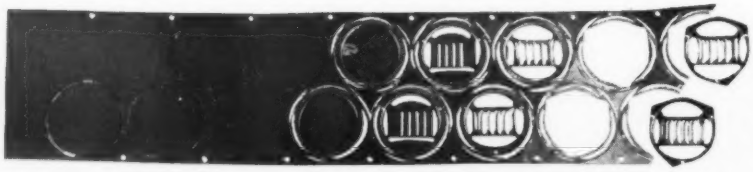
THREE OR FOUR conventional presses would have been required to produce this part, it is estimated by Emil Gaul, Grand Haven vice president. Among the features he likes about the Double Crank are: unequalled flexibility afforded by the large bed area, rapidity of die change, inching control and safety devices.

"Definitely improved our competitive position," is the way Mr. Gaul sums up the performance of his Henry & Wrights. They can improve productivity and work quality in your plant, too. Write for our catalog.

HENRY & WRIGHT

Division of Emhart Mfg. Co.

Hartford, Connecticut

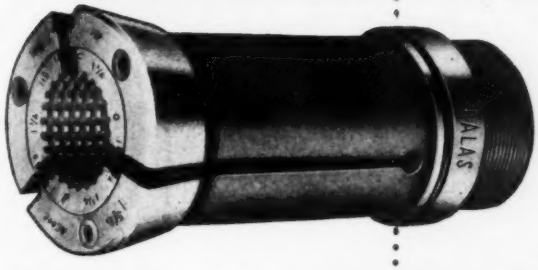


Six- and seven-station twin die lances, flattens, draws, pierces, forms and blanks out.

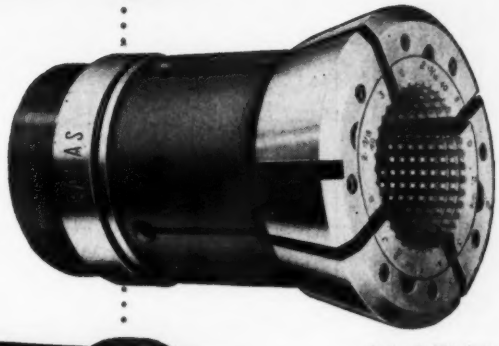
CIRCLE INFORM-A-GRAM KEY NO. 2

this little ring can save you
hundreds of dollars a year···
if it's in a

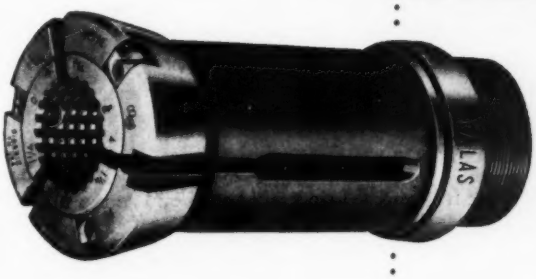
BALAS COLLET



Balas "CB" Collet



Balas "CT" Collet



Martin Master Collet

You can avoid "down time" by using Balas Collets with neoprene "O" Ring Seals. Experience proves that machines will run many months without withdrawing the collet tubes for cleaning when they are equipped with Balas "O" Ring Seal Collets...and best of all there's no extra charge for this extra feature!

Buy Balas Master Collets and assorted sets of collet pads so you can make full use of your machines. You save money because a set of pads is only about a third of the cost of a solid collet and "change over" time is shortened by hours.

Balas Solid and Master Collets are stocked in most sizes for all popular makes of automatics. With all their extra advantages they cost no more than ordinary collets! Save valuable time, material and money by standardizing on Balas for all your machines!

BALAS COLLET MANUFACTURING CO. / Cleveland 14, Ohio

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Special Size Reamers
ARE STANDARD WITH L&I

TWO MORE L&I EXCLUSIVES ...AT NO EXTRA COST!

DOWEL PIN REAMERS
Straight Shank, Right Hand Cut with Straight, Right or Left Hand Spiral Flutes.
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These reamers are two more reasons why L&I is the source for a complete reamer line.
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CHICOPEE, MASS.
CIRCLE INFORM-A-GRAM KEY NO. 4

TOOLING & PRODUCTION Magazine

FEBRUARY 1957
VOL. XXII—No. 11
GEORGE J. HUEBNER, Founder

Personally Speaking

Dear T&P Reader:

Last month I told you about our new front cover (hope you like it) and also that there would be other changes in Tooling & Production during 1957.

So many of you have asked our editors for a cumulative index of the articles that appear in T&P that in this issue you will find the start of this very desirable feature. Naturally, all of us are quite flattered. It's good to know that you enjoy the articles written for you in T&P. We're mighty glad to comply with your requests.

But there are many ways to organize this index and much thought was given to the problem before the solution was reached. It's quite different and unlike that of any other metalworking magazine. And, it is the direct result of trying to give you the most useful index possible. Here's the way it works.

In the back of this issue you will find the index for the articles appearing in January. Then in March we will carry the combined January and February indexes and so on throughout the year. Each index will list all of the articles appearing in all previous issues in a given year. The index will be arranged alphabetically both by subjects and titles so if you want to refer to a particular article or read up on a particular subject all you have to do is check the index.

Each issue of T&P, then, will be a reference source for articles in previous issues during the year. Since there is a lasting value for you in these articles you will want to keep each copy of T&P so you can refer to the proper issue quickly.

This new index has been created for you and is based on your need for a quick but complete reference. I sincerely hope you like it and will drop me a note if you have some ideas on the subject.

Good luck,

Ray L. Huebner

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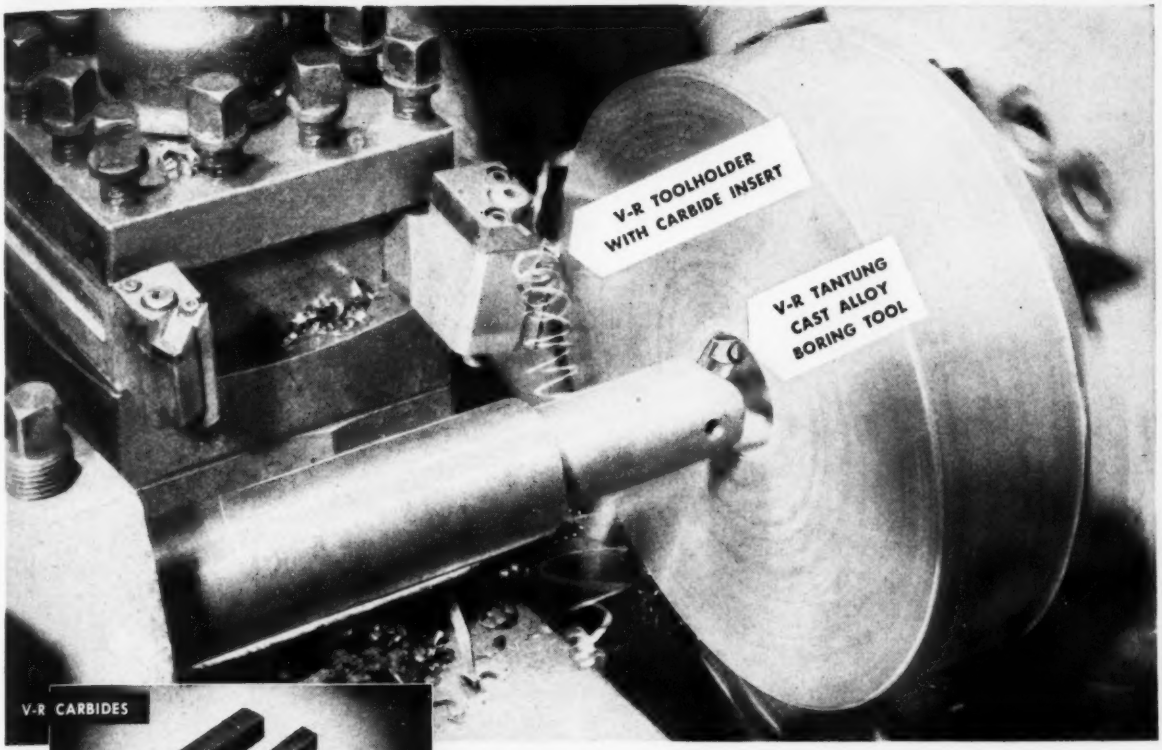
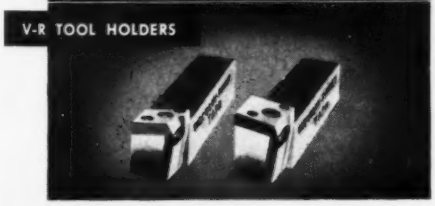
How Multiple Tooling with Carbides and Tantung Cast Alloy Can Reduce Machining Costs





Surface Speed Dictates Choice of Tool

The boring and turning operations on normalized oil hardening tool steel pictured above illustrate the economies possible by correct use of both carbide and cast alloy cutting tools. The 8″ O.D. is being turned at 450 surface feet per minute (215 RPM) with a V-R toolholder and throwaway carbide insert. The boring speed is 112.6 SFPM on the 2″ I.D. At this lower speed carbide tool life is drastically reduced by build-up, while H.S. steel tools fail prematurely because of excessive heat.

The answer is to use V-R Tantung cast alloy for the boring operation. At 112.6 SFPM Tantung tool life is markedly superior to carbide or high speed steel. The reduction in regrinds and downtime results in higher production and major cost reduction.

Vascoloy-Ramet manufactures a complete line of both carbide and Tantung cutting tools to provide maximum machining economy on any job. For complete details and CATALOGS, call your V-R Representative or Distributor or write to V-R today.

FREE Surface Speed Table and Tool Selector Chart

This handy chart shows the general cutting speed range for HSS, TANTUNG and CARBIDES . . . shows RPM for various diameters to deliver surface speed desired. Ask for your copy—no obligation.

MANUFACTURERS OF:
CEMENTED CARBIDES, TOOLHOLDERS and TANTUNG® CAST ALLOY CUTTING TOOLS

Vascoloy-Ramet Corporation

SUBSIDIARY OF FANSTEEL METALLURGICAL CORPORATION

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CT-607

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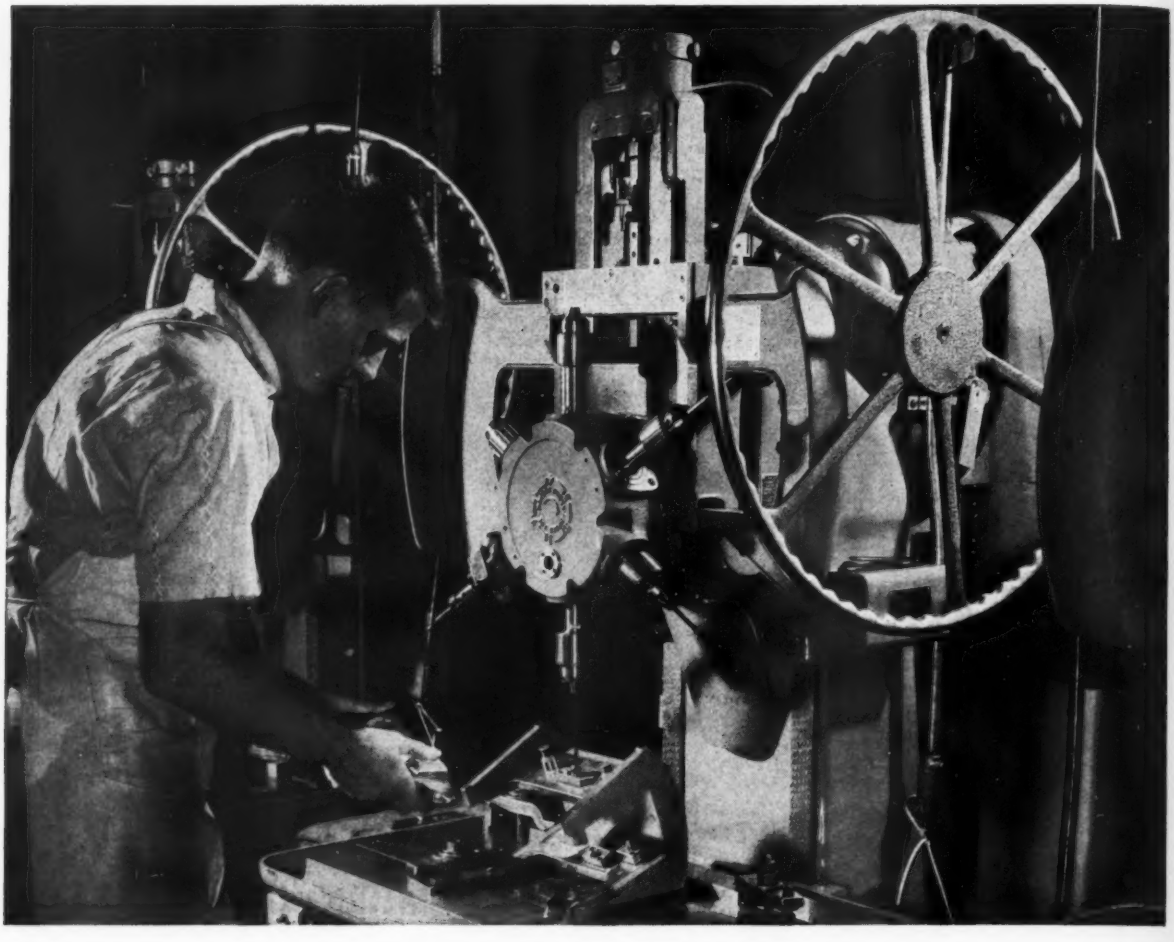

BURGMASTER® turret drills increase servo actuator production 25%

Here is what they say at Parker Aircraft Company, Los Angeles:

"Our bank of five 6-spindle Burgmaster turret drills have replaced a large number of single spindle machines and on this job performed thirty operations with a production increase of 25%. Drilling, tapping, counterboring and countersinking was accomplished with one set up. Lightweight fixtures could be used and, with fixture clamped in alignment under the spindle, a higher level of quality was maintained with improved finish. Repair work dropped to a minimum."

Automatic hydraulic Burgmaster (6-and 8-spindle models) feature skip indexing, automatic cycling and infinitely variable pre-selective feeds. All models (including the 6-spindle manuals and radial) provide power indexing, pre-selective spindle speeds and very close pre-selective depth control.

For complete information, write Dept. TP-2

BURG TOOL
Manufacturing Company, Inc.
15001 S. Figueroa St., Gardena, Calif.

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"WALES *Strippits* CUT OUR DIE-MAKING COST OVER 30%!"

"Die building was speeded up and costs cut when we standardized on Strippits replacing conventional die springs. Strippits eliminated counterboring for springs or stripper bolts, which also permits use of lighter die shoes. Only light stripper plates are necessary. For many dies, the even pressures and positive lengths of the Strippits eliminate the need for stripper plates or pressure pads altogether."

Production shops, too, benefit from Strippit-equipped dies. No need to remove dies from your press for costly disassembly to repair broken punches or springs. See illustration. Each Strippit is factory adjusted, tested and locked to assure perfectly uniform preload and stripping force. A complete line of Strippits is available from stock to meet all of your requirements, instantly and economically.

The STRIPPIT is a controlled spring stripping unit.

WALES *Strippit* COMPANY

"...the Wales-Way is the PLUS-PROFIT way"

AKRON, NEW YORK

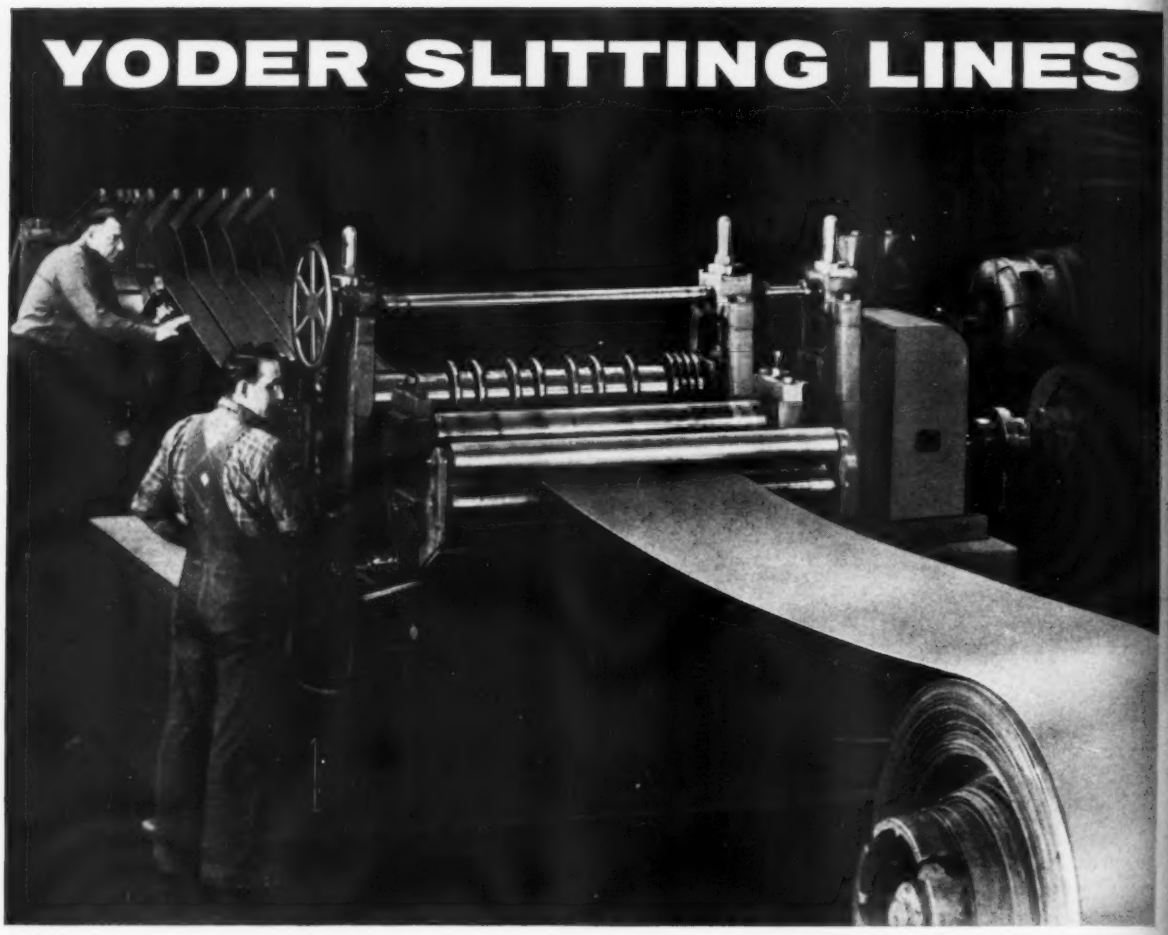
WALES-STRIPPIT OF CANADA LTD., HAMILTON, ONT.

SEND FOR BULLETIN No. 27A

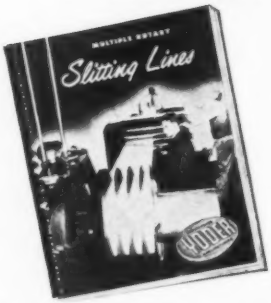
The STRIPPIT story should interest you. Send for your copy today.

CIRCLE INFORM-A-GRAM KEY NO. 7

YODER SLITTING LINES



pay big dividends working only one day per week!



The Yoder Slitter Book is a comprehensive treatise on slitter operation and economics, with time studies, cost analyses and other useful data. It is yours for the asking.

In one plant, two Yoder tube mills and about 50 punch presses are being supplied with slit strands by one Yoder Slitting Line operated an average of only *seven hours per week.*

In another plant, a Yoder slitting line, *operated from six to eight hours per week,* is supplying two intermittently operated roll forming machines with total requirements averaging 100,000 feet per week.

These typical examples demonstrate, first, the big potential output of a relatively small, inexpensive Yoder standardized Slitting Line and, secondly, its big profitability. Assume production of only 35 tons of slit strands per 8 hour shift, one day per week, and the total per year would be 1750 tons. Estimating the saving in slitting cost at only one-half cent per lb., the total annual saving would be $17,500.00.

Besides the big convenience of doing your own slitting, such savings will often repay the investment in a few months.

THE YODER COMPANY 5501 Walworth Avenue • Cleveland 2, Ohio, U. S. A.

ENGINEERING YODER MANUFACTURING

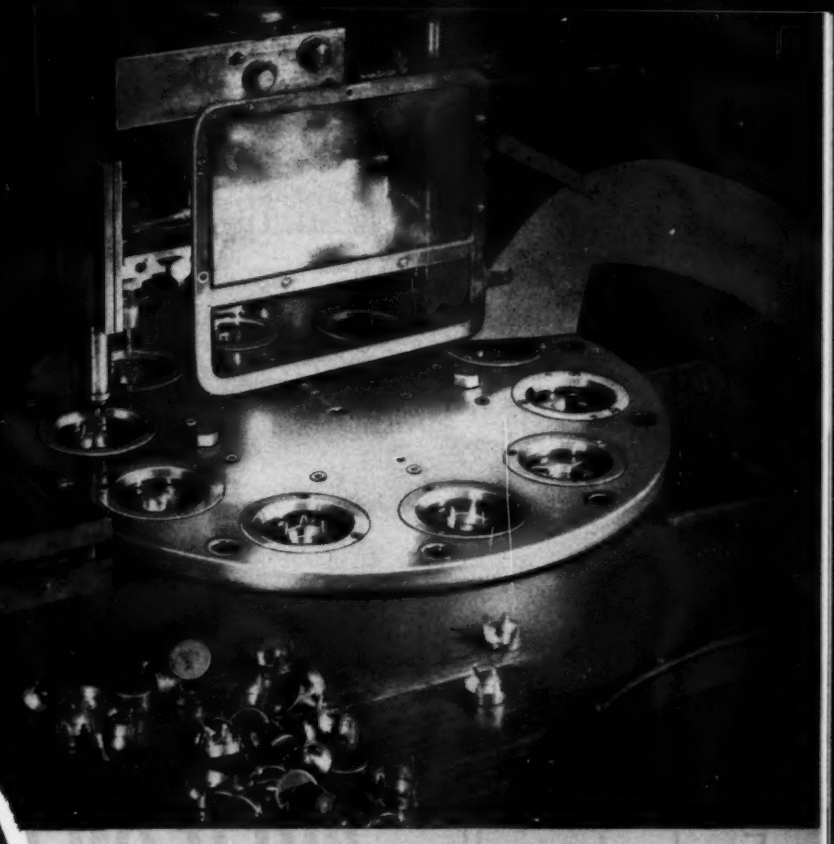
ROTARY SLITTING LINES

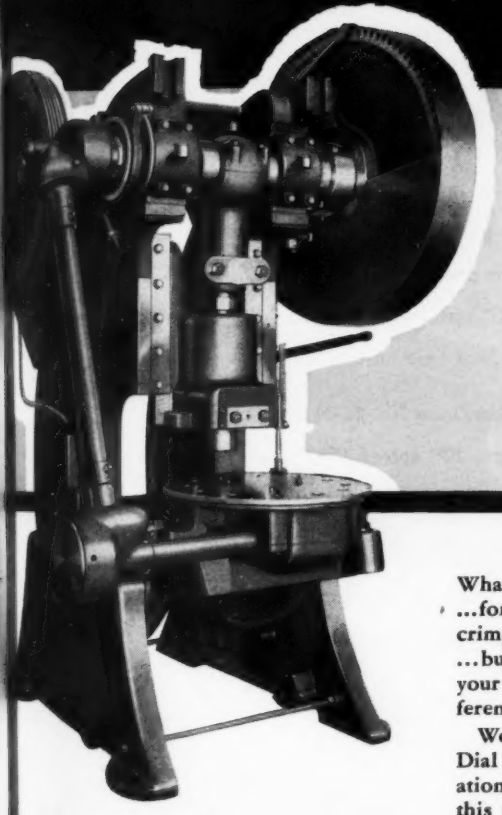
COLD ROLL FORMING MACHINES

ELECTRIC-WELD PIPE AND TUBE MILLS

CIRCLE INFORM-A-GRAM KEY NO. 8

MODERN FEDERAL DIAL FEEDS have what it takes!





No. 7 Dial Feed
Capacity, 80 tons

VERSATILITY plus AUTOMATION

What's the job? Drawing... staking ...forming... piercing... stamping... crimping... punching... broaching ...burring...assembling? Maybe in your plant it's all of them, or a different, unique operation.

We'll lay two-to-one that Federal Dial Feeds are just what your operation needs. For the possibilities of this press with special jigging are practically unlimited. Add automatic feed and ejection and you have the answer to many cost problems.

Modernize now with Federals and eliminate the need for expensive, specialized equipment. Rugged, precision-built Federals embody the finest materials and workmanship. Available in sizes from 6 to 80 tons. *Write for new Dial Feed Catalog.*

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707 Division Street, Elkhart, Indiana

FEDERAL DIAL FEED PRESSES

31 Years' Experience in Dial Feed Engineering and Construction

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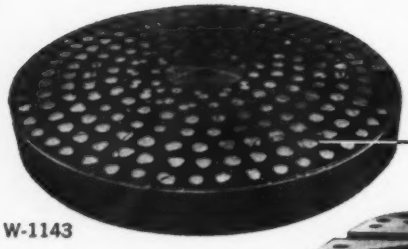


W-1143

tiny or **tremendous**...

W-1145

For best results...***PUT IT ON A BLANCHARD!***

Blanchard No. 18

Blanchard No. 42-84

There's a Blanchard for every surface grinding job, in a broad range of sizes. For example, the Blanchard No. 18 grinds non-magnetic transistor elements (upper left) .006" thick, to a tolerance of .0005" with good finish. This job, which involved .006" to .008" stock removal per side, was held on special fixture plates.

At the other end of the scale, a huge Blanchard No. 42-84 Grinder grinds a turbine housing (upper right) which measures 83" across the corners, and is 28" high. This housing, ground after rough machining, required .020" stock removal. Both this piece and its mating part were ground to a steam-tight joint.

Whatever *you're* grinding—be it tiny watch parts, giant steel plates, or anything in between—there's a Blanchard designed to do the job speedily and accurately.

Ask for details on the 15 standard Blanchard models.

PUT IT ON THE BLANCHARD

Send for free copies of "Work done on the Blanchard", fourth edition, and "The Art of Blanchard Surface Grinding".

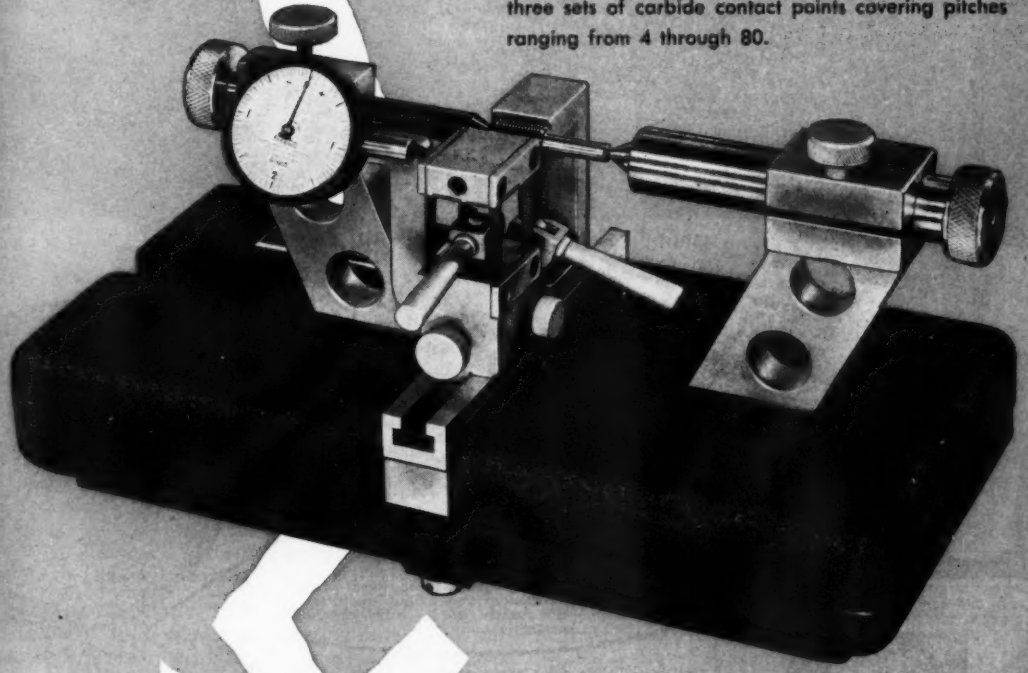
THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.

CIRCLE INFORM-A-GRAM KEY NO. 10

NEW! DRUNKEN THREAD CHECKER

Now, with the PMCo Drunken Thread Checker, it is possible to accurately check another element—"drunken threads." This new instrument, developed after many years of study, is manufactured of the finest materials, by a team of expert craftsmen. It simplifies accurate reading of helix deviation.

The PMCo Drunken Thread Checker has a capacity up to 3¼" diameter. Maximum measuring distance between centers is 5⅝". It is furnished complete with three sets of carbide contact points covering pitches ranging from 4 through 80.



THE PIPE MACHINERY CO.
29100 Lakeland Blvd. • Wickliffe, Ohio
Greater Cleveland

Today Get the Pipe Machinery Co. "Drunken Thread Checker" Pamphlet #3 Fill in this coupon.

Name _____
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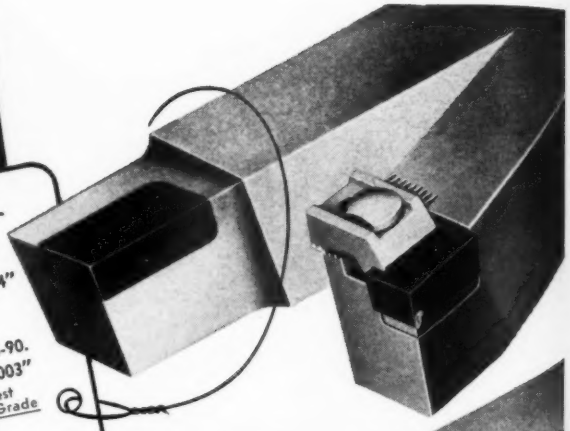
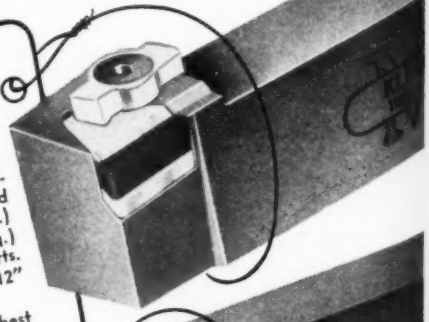
Talide® Tools... PROVED BEST BY TEST!



COSTS ONLY $1.65 Leading appliance manufacturer gets superior results with Talide standard brazed-type tool.

Machine.....Gisholt Turret Lathe.
Part.....Stud for automatic washing machine 3/4" dia. x 4" long, 1045 Steel, Rockwell 28 "C".
Operation.....Complete finishing including threading of end.
Tool.....Standard Talide tool AL-10-5/8" sq. x 4", Grade S-90.
Speed (S.F.M.)....400 Feed.....005" Depth of Cut.....003"

	Talide Grade S-90	Next Best Premium Grade
Average No. of pcs. per grind	600	475
Average No. of regrinds per tool	16	14



90 DAYS OF GRUELING TESTS at eastern aircraft engine plant rates Talide Grade S-92 "Best by Test."

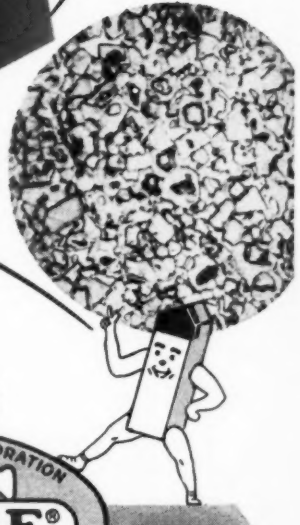
Here is one typical result:
Machine.....36" Bullard Multimatic
Material.....AMS-5613 Stainless Steel
Operation.....Facing, turning and boring 21" O.D. x 2.5" thick casting to size. (Heavy scale, bead weld, and out of round surfaces presented adverse machining conditions.)
Tools.....TN-163P3 (1/2" I.C.) and SN-243P3 (3/4" sq.) Talide "Throw-away" triangular and square inserts.
Speed (S.F.M.).....375 to 1100 Feed.....006" to .012"
Depth of Cut....060 to .500
Result.....27-34 Pc. average compared to 7-12 for next best premium grade—plus tool breakage cut 75%.

BEST CUTTING METAL FOR MACHINING CRANKSHAFTS

A large midwest automotive plant recently conducted an extensive test to determine the best cutting metal for machining crankshafts—the results proved TALIDE "BEST BY TEST!"

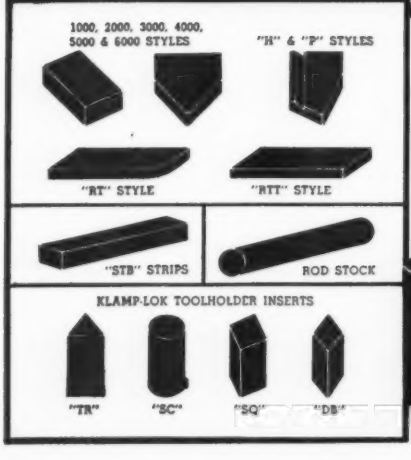
Machine.....Fay Automatic Lathe Feed.....006"
Speed.....800 R.P.M. Depth of Cut.....035"
Cutting Tool.....Style TB-12123 Triangular Insert

Material	Talide Grade S-90	2nd Best Carbide	3rd Best Carbide
1141 Steel	175 pcs.	120 pcs.	97 pcs.
4140 Steel	128 pcs.	70 pcs.	65 pcs.
Armor Steel	83 pcs.	65 pcs.	65 pcs.



CONSTANT RESEARCH PAYS OFF!

Year after year Talide metal improves in hardness, strength, rupture resistance and crater resistance properties. Processed in latest type vacuum electric furnaces under rigid laboratory control—all Talide grades are uniform and consistent in quality.



Call in a Talide sales engineer to recommend proper tooling for your machining operations, or write for 76-page catalog No. 56-G. METAL CARBIDES CORPORATION, 6001 Southern Blvd., Youngstown 12, Ohio.

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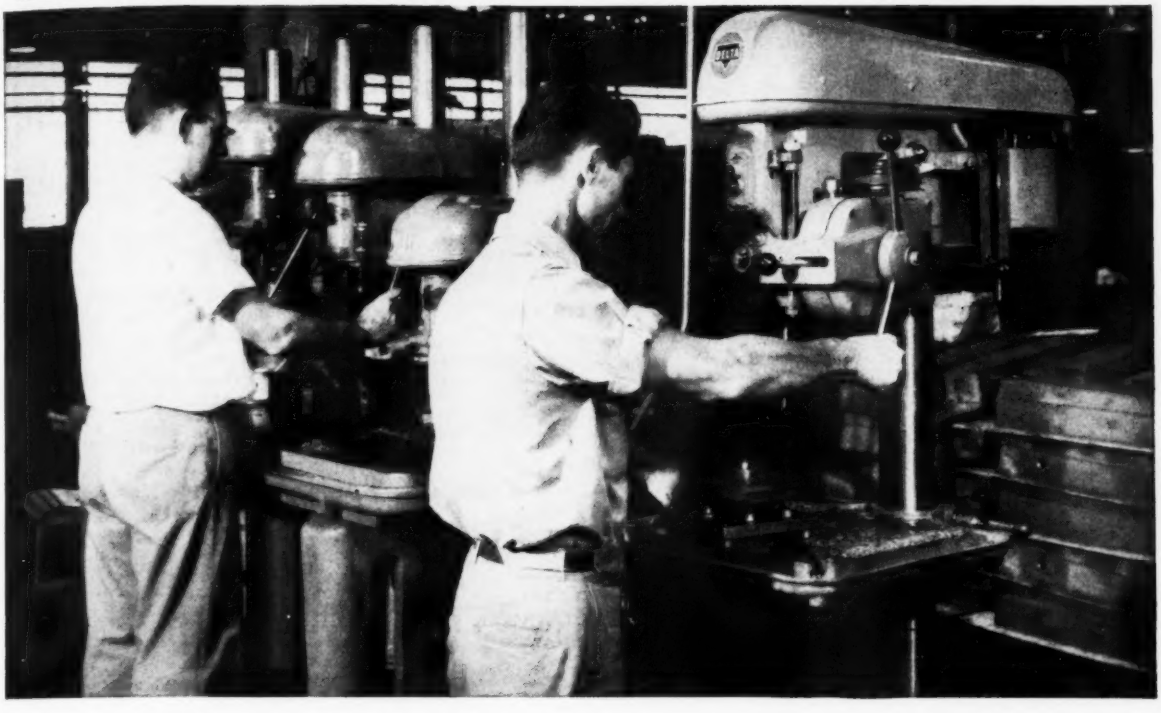
TALIDE®
YOUNGSTOWN 12, OHIO

HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • ALUMINUM OXIDE • HI-TEMP. ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

CIRCLE INFORM-A-GRAM KEY NO. 12

ROCKWELL-BUILT

new DELTA 20" drill press



...fills need for low cost production tooling

Delta's great new 20" Drill Press was designed, engineered and built to fill industry's growing need for *flexible* production tooling. Here is why it can save you money by handling jobs normally requiring machines *costing four and five times as much:*

BIG MACHINE CAPACITY—You get full 6" spindle travel and long 5½' high column for *extra* spindle to table capacity, backed by massive construction and rugged power to match! It's a real production tool for jobs ordinarily demanding big, expensive special-purpose machines.

POWER TOOL VERSATILITY—New Delta 20" can be used singly for a wide range of production jobs, yet readily adapts to work in combination with special-purpose machines. And you can move it *where you need it* to reduce materials handling, save costly man hours.

LASTING PRECISION—Delta's 30 years of unmatched quality power tool experience give you precision and performance features that assure exacting tolerances (and lower maintenance) through years of hard, continuous operation.

SEE THE ENTIRE DELTA DRILL PRESS LINE: Get all the facts about the new Delta 20" plus other new and improved Delta Drill Presses. Compare for quality, for precision, for value—and make up your *own* mind! Your Delta Dealer is listed under "TOOLS" in the Yellow Pages of your phone book.

Send coupon for all the facts!

DELTA ROCKWELL

another product by **ROCKWELL**

Delta Power Tool Division, Rockwell Manufacturing Co.
622B N. Lexington Ave., Pittsburgh 8, Pa.

- ☐ Please send complete catalog on entire Delta Drill Press line.
- ☐ Please send booklet: Delta Power Tools Teamed with Machine Tools.
- ☐ Please send names of my nearest Delta Dealers.

Name_____ Title_____

Company_____

Address_____

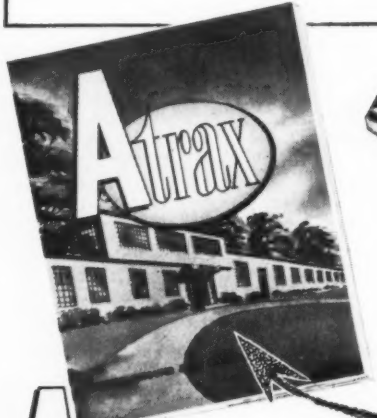
City_____ County_____ State_____

CIRCLE INFORM-A-GRAM KEY NO. 13

We're very proud and pleased to announce the latest and largest edition ever of the Atrax Catalog is now ready for distribution.

100 colorful pages, crammed with the most complete line of precision, solid carbide tools available—and with vital, useful information on the use, care and maintenance of Solid Carbide Tools.

See hundreds of standard End Mills, Burs, Reamers, Drills, Routers, Grinding Tools and Special Solid Carbide Tools Engineered to keep your production breaking new records! A 28 page price list will be included. These two necessary references to tooling service, superiority and economy are yours by return mail—FREE!



Send for your copies . . . NOW

Atrax

Finish FIRST with Carbide!

THE ATRAX COMPANY
Newington 11, Connecticut

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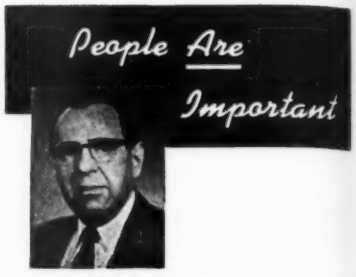

by Erwin K. Taylor, Ph. D.
President
PERSONNEL RESEARCH AND DEVELOPMENT CORP.
Cleveland 20, Ohio

WHO HIRES?

HIRING NEW EMPLOYEES is a line responsibility. But the staff departments, particularly the personnel department, can be very helpful. The personnel people can help you write the job description on which you can base the requirements of a job. They can do the recruiting and preliminary interviewing. They can screen out undesirable applicants and test and interview desirable ones. They can provide a great deal of useful information that will help the operating man make a better decision, but decision making and responsibility for it is a line function.

It has been my feeling for a long time that the man who should have the final say in a selection situation is the man to whom the successful applicant will report when on the job. He should have at his disposal all of the information that the personnel department can supply him. He may want at times to secure and consider the opinions of other members of management, but even with all this material he should and will usually want personally to interview at least the best two or three applicants. There are several well established and easily applied principles of good interviewing. If you apply them in your own interviewing, they will probably help you improve your batting average as a personnel selector. Here are a few that you may find helpful.

1. Use the interview to measure what cannot be measured more accurately or economically by other means. Interviewing time is expensive. Don't squander it. If you want to know how bright an individual is, don't try to estimate his intelligence in the interview. Let the personnel department give him one of many accurate and well standardized intelligence tests. It will do a good job without taking up your valuable time.

2. Get new or additional information. Review all the data about the applicant before the interview. Study

. . . *Continued on page 26*

BULLARD

Announces the acquisition of the

HYDRA-Z FEED Lathe

(FORMERLY MANUFACTURED BY HYDRA-FEED MACHINE TOOL CORPORATION)

AVAILABLE IN THREE MODELS TO MEET A WIDE RANGE OF REQUIREMENTS

FEATURES

Unobstructed front view design allows faster loading and unloading . . . easier set-up . . . with less operator fatigue.

When used as a tracer lathe templates are above work piece where dirt, chips and cutting oils cannot interfere with work accuracy.

Oversized chip chute with pan below the entire work area . . . readily accessible from end, rear or bottom of machine.

Massive strength and rigidity with extra power to take full advantage of maximum feeds and speeds obtainable with multiple carbide tooling.

THE BULLARD COMPANY

286 CANFIELD AVENUE — BRIDGEPORT 9, CONNECTICUT

Please send me a copy of the

BULLARD HYDRA-FEED CATALOG

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COMPANY _____

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CITY _____ ZONE _____ STATE _____

CIRCLE INFORM-A-GRAM KEY NO. 15

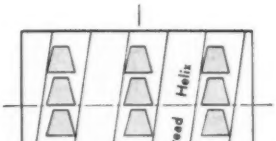
BARBER-COLMAN offers

thread milling requires accurate cutter design!

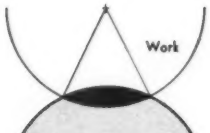
mathematical computation of cutter form

Multiple thread milling cutters often produce a thread space form which is not a duplicate of the cutter tooth form. The cutter tooth form is not a duplicate because the cutter tooth rotates in a plane which is perpendicular to the work axis and at an angle to the thread helix. This generating action produces a fillet at the bottom of the threads, and a thread space which is wider than the cutter tooth. When the amount of generating produces an unsatisfactory thread form, the cutter must be developed to produce the desired thread tooth thickness without fillet interference.

Whenever required, Barber-Colman engineers, by mathematical computation, design the correct cutter which compensates for the generating action. In this computation, the diameter of the cutter is very important since the amount of tooth form correction increases as the diameter of the cutter increases. A thread produced by a specially-developed cutter will have an accurate form which will fit the gage with the desired bearing.

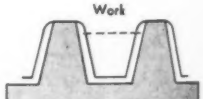


This schematic drawing shows how a multiple thread milling cutter produces a thread space which is wider than the cutter tooth. The cutter is set so that the plane of rotation of the cutter teeth is perpendicular to the work axis, and at an angle to the thread helix.

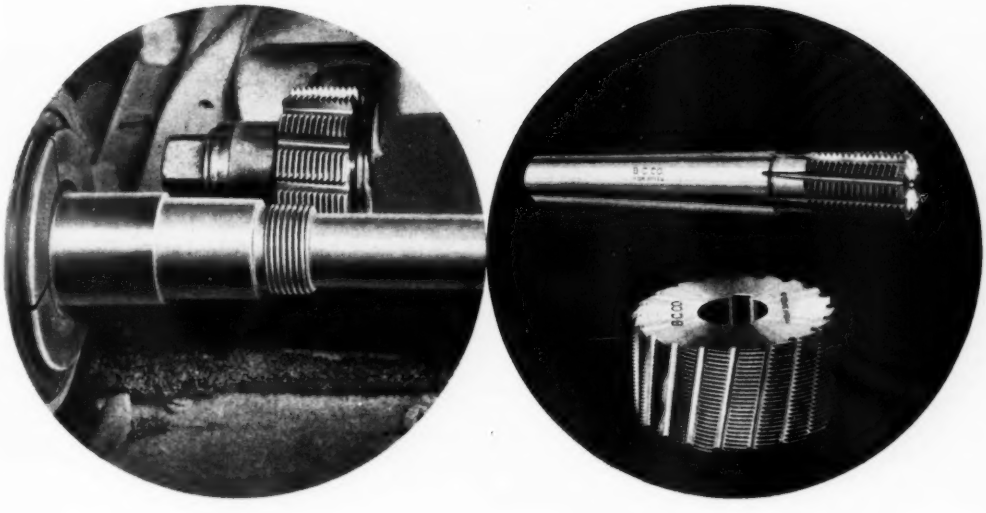


Large diameter cutters have greater length of contact and produce more pronounced fillets.

Small diameter cutters have less length of contact and produce smaller fillets.



In some cases, cutters mill deeper than true thread form. Any generated fillets which may be cut are then below the gaging surface of the thread. Correct cutter design takes care of this automatically.



original cutter accuracy in resharpening

All Barber-Colman form-relieved milling cutters are accurately index-sharpened on Barber-Colman automatic sharpening machines, so that all cutter teeth are the same height and accurately spaced. This makes it easy to maintain original cutter accuracy when resharpening either on automatic sharpeners, or on conventional sharpening equipment using the accurately indexed cutter teeth as a reference. In either case, accurate sharpening to original tolerances is easily maintained, and cutter sharpening time is reduced to a minimum.

design elements for maximum performance

With the proper tooth form developed to cut accurate threads, the engineers then analyze the job conditions to determine which cutter features will produce best cutter performance. These features include selection of the proper cutter material, shell or shank type cutters, straight or helical flutes, rake teeth, axial relief and intermittent teeth if sharp threads are desired. Since we make all classes of ground and unground thread milling cutters, we can recommend the cutter accuracy required for your job.

When you have a threading problem, consult Barber-Colman cutter engineers for their recommendations on the proper cutters for the job. Be sure the cutters you have are accurately designed to cut the correct thread form. Send us blueprints of your threaded parts for quotation on thread milling cutters designed to produce correct threads.

BARBER-COLMAN COMPANY

8102 ROCK STREET • ROCKFORD, ILLINOIS

Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

BARBER COLMAN

CIRCLE INFORM-A-GRAM KEY NO. 17

CHOMIENNE

5" VERTICAL SHAPER

Designed and built to meet the most exacting U.S. precision engineering standards.

The Chomienne Vertical Shaper with 5" stroke is a compact rugged machine, ideal for accurate slotting operation. A must to the well equipped die shop. It is a proven time and work saver on jobs requiring machining of irregular shapes and forms.

Users report it's the most-used machine in their shops. Operators like its ease and simplicity of set-up and operation.

Low in initial price, Chomienne Vertical Shapers will repay their investment through savings in time and fixture costs alone. Parts and fast service are available from all major cities. Write for catalogs—

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76-X MAMARONECK AVENUE • WHITE PLAINS, NEW YORK

DEALERS IN PRINCIPAL CITIES • LOOK FOR THE AUSTIN SEAL . . . YOUR FULL GUARANTEE OF SATISFACTION

CIRCLE INFORM-A-GRAM KEY NO. 18

Here's an Idea

FOR YOUR SUGGESTION BOX . . .

Postiv-Lok tooling reduces costs as much as 25% or more by eliminating the integral taper shank from large end mills and putting it on a holder. The Postiv-Lok holder soon more than pays for itself through cost savings on end mills. The Postiv-Lok design also assures reduced set-up and change-over time on a machine when production requires switching from one end mill to another.

The versatility of application, found only in Postiv-Lok tooling, also saves much time, work and cost when changing a machine from one type of tool to another. For, a machine equipped with a Postiv-Lok holder is quickly and easily converted from milling to drilling, reaming or other operations. Postiv-Lok adaptors for various tools assure easy insertion and removal from holder with a minimum of machine down-time.

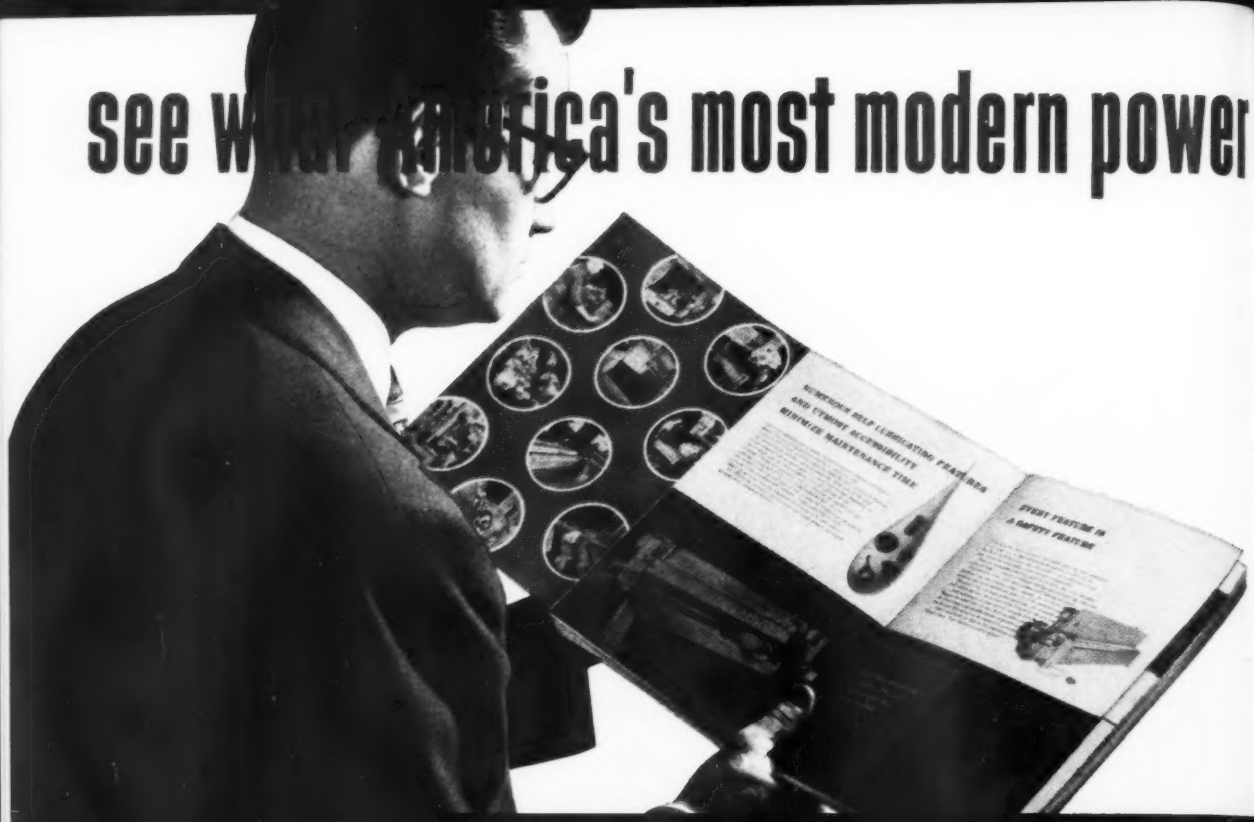
The standard line of Putnam Postiv-Lok end mills will in most instances provide a tool that exactly meets your cutting requirements. However, we will manufacture to your exact specifications special Postiv-Lok cutting tools.

Your local Putnam distributor will be happy to discuss tooling problems with you, make recommendations or quickly serve your needs with standard Putnam end mills . . . we suggest you contact him for quality service and use Postiv-Lok on the big jobs for best results.

PUTNAM
TOOL COMPANY
2981 CHARLEVOIX AVENUE • DETROIT 7, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 19

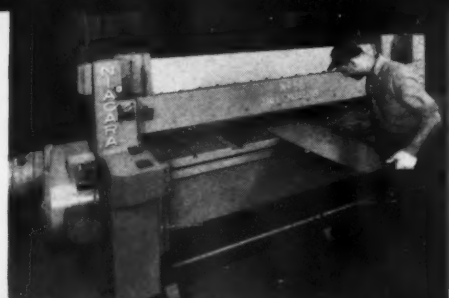
see w[illegible]ica's most modern power



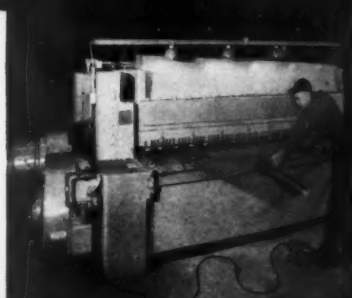
SHEAR USERS EVERYWHERE TELL THEIR STORIES OF NIAGARA BENEFITS

(3 of 19 Photo-Reports shown in Niagara's new Bulletin 69G)

"an exceptional machine value"
— World's Largest Trailer Mfr.



"For over 10 years . . . we have never had any downtime for repairs and maintenance."
— V-Belt Pulley and Caster Mfr.



"High quality of accuracy with the utmost in speed and performance
— Midwest Road Machinery Mf

squaring shears can do for you!

Speed that spells peak productivity! Accuracy for cutting within micrometer tolerances! Ruggedness to stand the gaff on stiffest assignments! They're all yours with a Niagara Power Squaring Shear. New, fact-filled 74-page Bulletin is profusely illustrated to show you how and why:

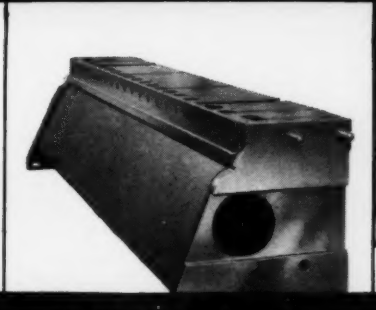
From mass producers, fabricating plants, steel warehouses and sheet metal shops comes written evidence of the superiority of Niagara Underdrive Squaring Shears on jobs of every description. *No other shear can match Niagara's record for cutting accuracy, speed and downright economy of operation.*

For a photo story of the many tangible ways in which a Niagara Power Squaring Shear can boost hourly output, improve quality and slice maintenance costs in your plant, make sure that you receive Niagara's newly-published Bulletin 69G by mailing the coupon below. Presenting the greatest shear story ever told this 74-page document will give you a close look at Niagara Shears in numerous applications . . . the *closest* look you have ever had at *any* shear, next to having it on your own floor! It will show you feature-by-feature why a Niagara Shear is far ahead at every point of comparison . . . and why it pays to look to America's oldest leading shear manufacturer for the most profitable answers to *your* requirements.

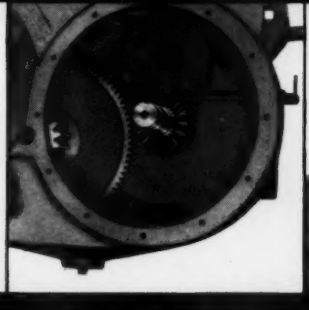
NIAGARA-DEVELOPED FEATURES PROVIDE THE ULTIMATE IN MODERN SHEAR PERFORMANCE

(Here's a glimpse at just a few of many. See them ALL in new Niagara Bulletin 69G)

Fully Closed Box Type Construction



Massive Bed Designed for Super Strength

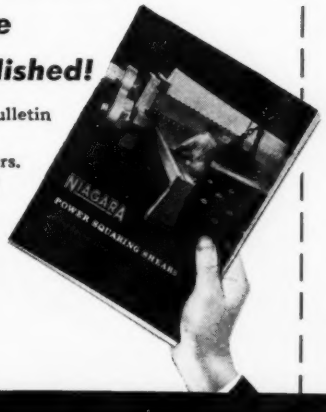


Instantly Engaging Multi-Jaw Clutch

Powerful, Self-Compensating Holddown

YOURS FOR THE ASKING...

the most comprehensive shear bulletin ever published!



Months in preparation, this fact-filled bulletin now gives you valid, inside facts on the nation's top line of power squaring shears. 74 pages! 141 revealing photographs and illustrations! Specifications for nearly five dozen standard models! Capacities: 16-gage to 1" mild steel. Cutting lengths: 4 to 20 ft. Make sure that you receive a copy at once. Mail the attached coupon today.

NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N.Y.

MAIL your new Underdrive Squaring Shear Bulletin 69G to us immediately.

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COMPANY _____

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CITY _____ ZONE _____ STATE _____

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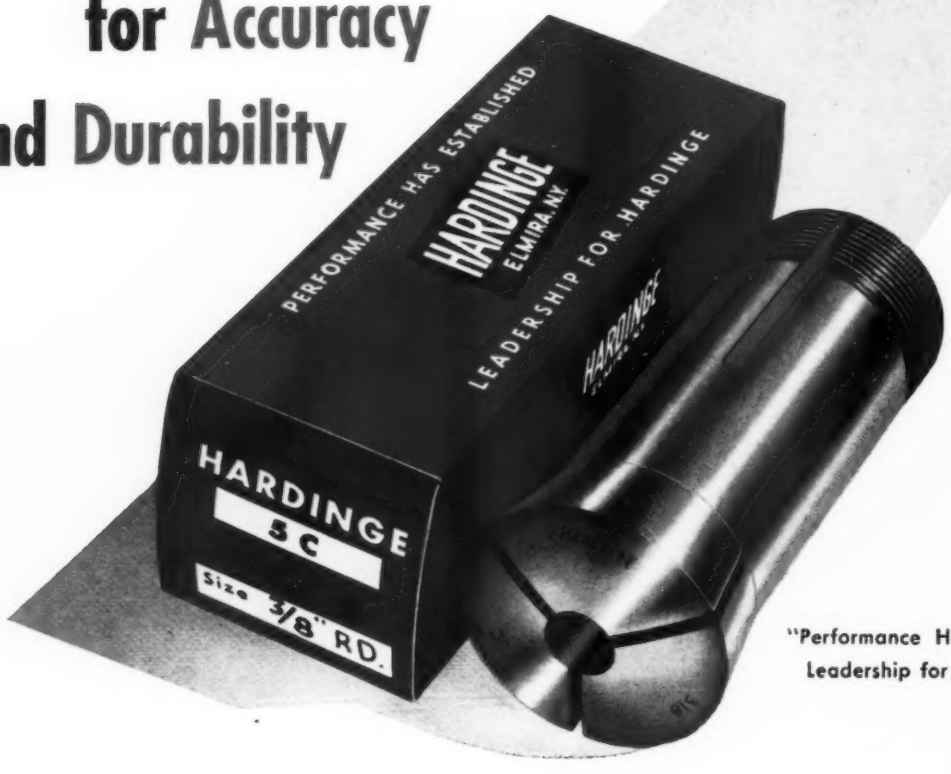
HARDINGE
ELMIRA, N.Y.

Specify HARDINGE Collets for Accuracy and Durability



"Performance Has Established Leadership for HARDINGE"

For Your LATHES and MILLING MACHINES

HARDINGE Draw-in Collets symbolize accuracy, long life, and low cost because they are hardened and ground both internally and externally, have heat treated threads, — and cost no more than ordinary collets.

HARDINGE Collets assure you of all - essential accuracy plus durability and economy.

Write for Bulletin 56 — complete collet ordering information for all Lathes and Millers.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

"Immediate stock delivery from Elmira, Dayton, Chicago, Minneap olis, St. Louis, Detroit, San Francisco, Los Angeles, Philadelphia, Hartford, New York"

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NEW...
today's lowest-priced "working" gage blocks

Johansson Thrift Blocks

±.000008" accuracy and parallelism
1.0 to 1.5 micro-inch RMS surface finish
.000006" flatness

Buy through your local distributor

Two Sets Available

Set No. 1 (84 blocks)
.100" to .200" by .001"
.200" to over 12" by .000025"
A half million different gaging sizes

Set No. 2 (36 blocks)
.300" to over 8" by .00005"
Over 150,000 different gaging sizes

B·S

Brown & Sharpe

MILLING, GRINDING, AND SCREW MACHINES
CUTTERS
MACHINE TOOL ACCESSORIES
PRECISION TOOLS
PUMPS

Now high precision standards for use "on-the-job" are practical in any shop! New Brown & Sharpe "Thrifty Jo's" give you "Class B" block accuracy at greatly reduced cost. You can use "Thrifty Jo's" to check the accuracy of your regular working gages. Or, you can assemble them into actual working gages, using Brown & Sharpe Jo-Block Accessories. They save time and money on literally hundreds of different measurements in every department.

Brown & Sharpe's "Thrifty Jo's" are available at your Brown & Sharpe Distributors. In sets of 84 or 36 blocks, or as individual, standard sizes. Thrift carbide wear blocks available for use as outer blocks. Send for Catalog of complete Jo-Block Line. Brown & Sharpe Mfg. Co., Providence, R. I.

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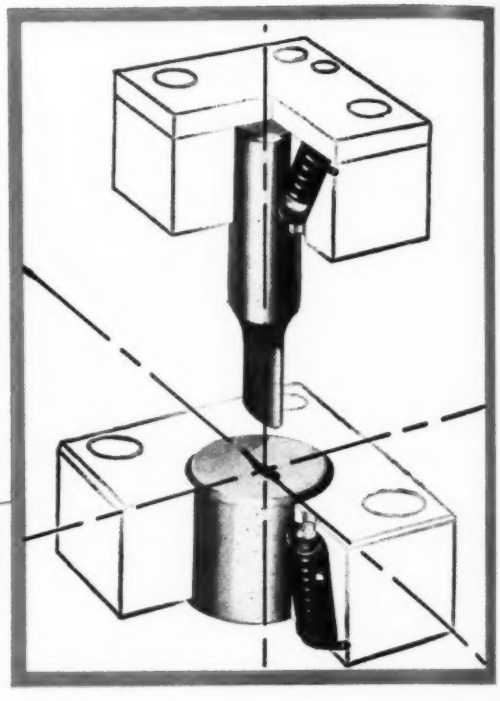
WHY R-B Punches are easier to use



Just a push, a twist, and "click" your R-B punch or die button is accurately ALIGNED and LOCKED in place. The R-B ball lock prevents radial or vertical movement of the punch or die button in the retainer—no additional keying is required. R-B punches and die buttons are just as easy to remove—simply insert tanged tool in retainer hole to release ball lock. Standardized and completely interchangeable in any shape or size, these easy to use punches and die buttons save your time and energy.

No other manufacturer of punches and die buttons can offer you the amount of successful application experience and the scope of knowledge that is available from the R-B engineering staff for:

- ★ Cutting Your Production Costs
- ★ Reducing Die Designing Time
- ★ Increasing Productivity of Presses
- ★ Supplying Answers to Piercing Problems
- ★ Saving Die Construction Time
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For Additional Information or Engineering Service, Write to:

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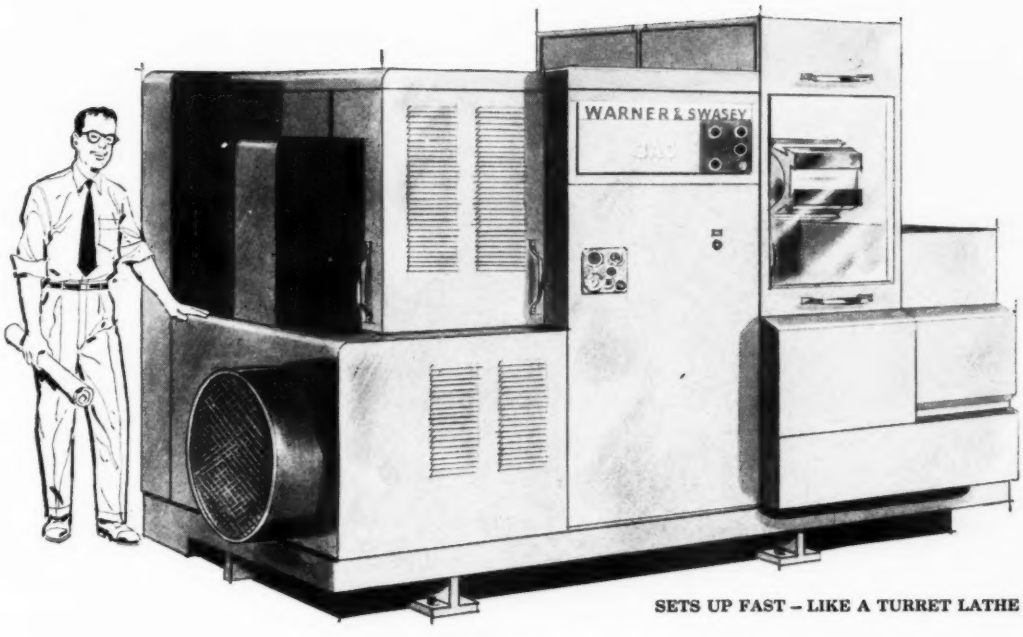
DEPT. 85 • 26476 CAPITOL AVENUE • DETROIT 39, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 24

NEW...



SETS UP FAST – LIKE A TURRET LATHE

Warner & Swasey 3AC Single Spindle Automatic Chucker widens field of profitable turning jobs

This versatile, new model was engineered for fast, automatic machining of your larger, complex chucking jobs. It provides accuracy, metal removal capacity, tooling flexibility and set-up ease and speed heretofore unobtainable by automatic operation in this work range.

For over eight years, enthusiastic users have told us, "Performance records of our Warner & Swasey Single Spindle Chucking Automatics have been phenomenal."

The 1AC model, first introduced at the 1947 Machine Tool Show in Chicago, met with instant field acceptance. In 1953 — 88 customers placed orders for the 2AC model before the first machine was ever built!

Now, Warner & Swasey announces a new, larger capacity, more powerful 3AC model with a 15-inch diameter chuck and a 40-horsepower motor, which will provide fast, automatic production for your larger pieces — precision and otherwise — in all lot sizes.

Our Field Representative will be glad to give you complete details on how this new machine can increase profits on your operations. Why not call him in, today?

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

No Matter Which Way You Turn...Warner & Swasey Cuts Costs

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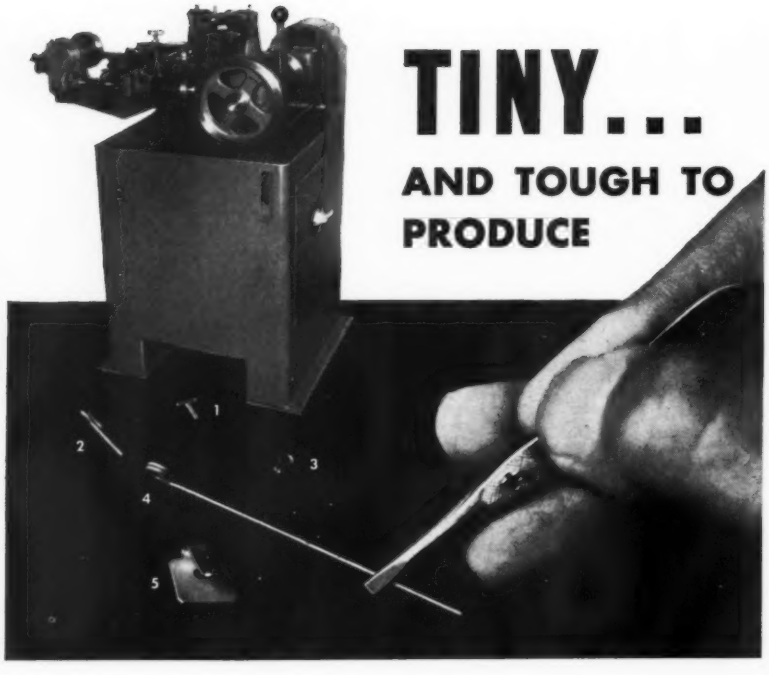


TINY...

AND TOUGH TO PRODUCE

INTRICATE FORMING IS AUTOMATIC ON A NILSON 4-SLIDE

Small wire and ribbon metal forms shown here in actual size are typical examples of modern precision production on a Nilson #00 4-Slide. Compact in size, this 4-Slide produces up to 375 pieces per minute in material not exceeding .040 dia. and 3" in blank length. Easy access to tooling, accurate feeding to within .003, and rugged construction assures years of precision forming.

1 Mercury Switch Part . . . .014" x .019" platinum wire, formed with tolerances within .001" on over-all length. Production rate, 175 per minute.

2 Electrical Contact . . . .0076" x .0030" wide phosphor bronze formed at a production rate of 200 per minute.

3 Swivel Part . . . .025" brass wire. Heading operating includes eye formed with tolerances within .008", shank within .003 tolerance. Production rate, 300 per minute.

4 Leadwire . . . .026" soft tinned copper wire formed at a rate of 140 per minute with two 7/64" diameter windings.

5 Contact Part . . . .010" x 3/8" wide phosphor bronze formed at 175 per minute.

Nilson makes a complete line of versatile 4-Slides . . . accommodating wire diameters up to ½", feed lengths up to 32", and ribbon metal up to 3" width . . . with press capacities ranging to 75 tons.

Nilson provides specific forming recommendations from detailed information. Send for A. H. Nilson catalogs . . . the first step to increased production.

A.H. NILSON MACHINE COMPANY

1522 RAILROAD AVENUE BRIDGEPORT 5, CONN.

Automatic Chain Making Machines • Staple Forming Machines • Wire and Stock Reels • Wire Straightening Equipment • Slide Feeds for Presses • Wire and Ribbon Stock Forming Machines

CIRCLE INFORM-A-GRAM KEY NO. 26

. . . Who Hires? from Page 14

the application form and personnel department report for a few minutes before starting the interview. It will tell you much about the man, can save you a great deal more time than it takes.

3. Plan your interview. It's generally a pretty good idea to work from an interview outline. This should not be a rigid set of the questions you intend to ask but rather a map of the territory that you hope to cover. Interviews are probably most useful in measuring attitudes, work habits, and the like. Plan your interview to tap these areas.

4. Get the interviewee to talk. Remember that the purpose of the interview is to get information about the applicant. You do not get much while you are talking. One research study of selection interviewing found that all interviewers spoke at least 50% of the time, while in some instances the interviewer did 90% of the talking. You don't get much information when you monopolize the conversation.

5. Avoid questions that can be answered by yes or no. Don't ask the candidate if he has had experience on a National Acme Multiple Spindle lathe. Ask him, rather, to tell you about the machines he has operated and what he has done on each of them. This gives you a much better basis for arriving at a sound judgment.

6. Allow enough time. A man is a pretty complicated piece of machinery. There isn't much you can find out about what makes him tick in five or ten minutes. A minimum of a half hour should be allowed for even the most menial job. It may save you many, many hours of headaches later.

7. Separate interviewing from selling. It is frequently necessary, especially in a tight labor market, to sell the job and the company to the applicant. This is a legitimate function of line management people as well as of the people of the personnel department, but sometimes we get so intent on selling the job that we forget in effect to interview the candidate.

8. Don't wear kid gloves. I think that too much has been made of the business of "Putting the candidate at ease", or as has sometimes been said, establishing *rapport;* we sometimes on this account conduct a very superficial interview. If a man can't take a little probing or becomes flustered when contradicted in an employment interview, how well is he going to take orders or even criticism if you hire him? If he's too quick to take offense, the time to find it out is before you put him on the payroll.

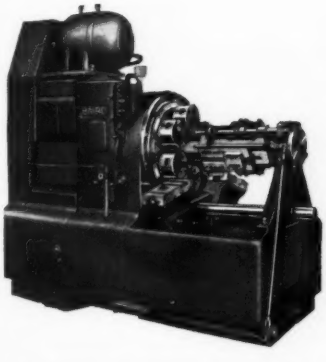
9. Get him to talk about people. Men reveal themselves most when

. . . *Continued on page 32*

...ask BAIRD about it

Tooling like this on a BAIRD 76H CHUCKER

can change *your* whole cost picture too . . .



industry's most versatile high production chuckers

To drop from dollars to cents in the unit cost of machining a workpiece is not unusual on a Baird installation. The secret lies in the basic design of this unusual work-rotating machine which permits practical "bug-free" tooling for an almost unlimited range of operations . . . and is equipped for single-cycle or double-indexing, with manual or auto load, auto eject, or full automation as may be required.

On the job illustrated above . . . die cast aluminum starting motor end plates . . . a feature is that only the first two of the six spindles revolve, at which time both sides of the flange are faced, both locating diameters turned, the center hole rough-bored, faced and chamfered, and inside hub back-faced and chamfered. The remaining stations, #3, #4 and #5, are stopped and accurately positioned while powered tools mounted on the tool slides finish-bore the center hole, tap two 1/4-20 holes, and bore one .313-.315 diameter hole off-center.

Sequence of Operations: Face both sides of .421 - .425 flange, turn and chamfer 4.087 - 4.083 and 3.868 diameters, rough and finish-bore .8115 - .8130 center hole, back-face and chamfer inside hub (recessing head), face and chamfer outer hub, tap two 1/4-20 holes, and bore one .313 - .315 diameter hole.

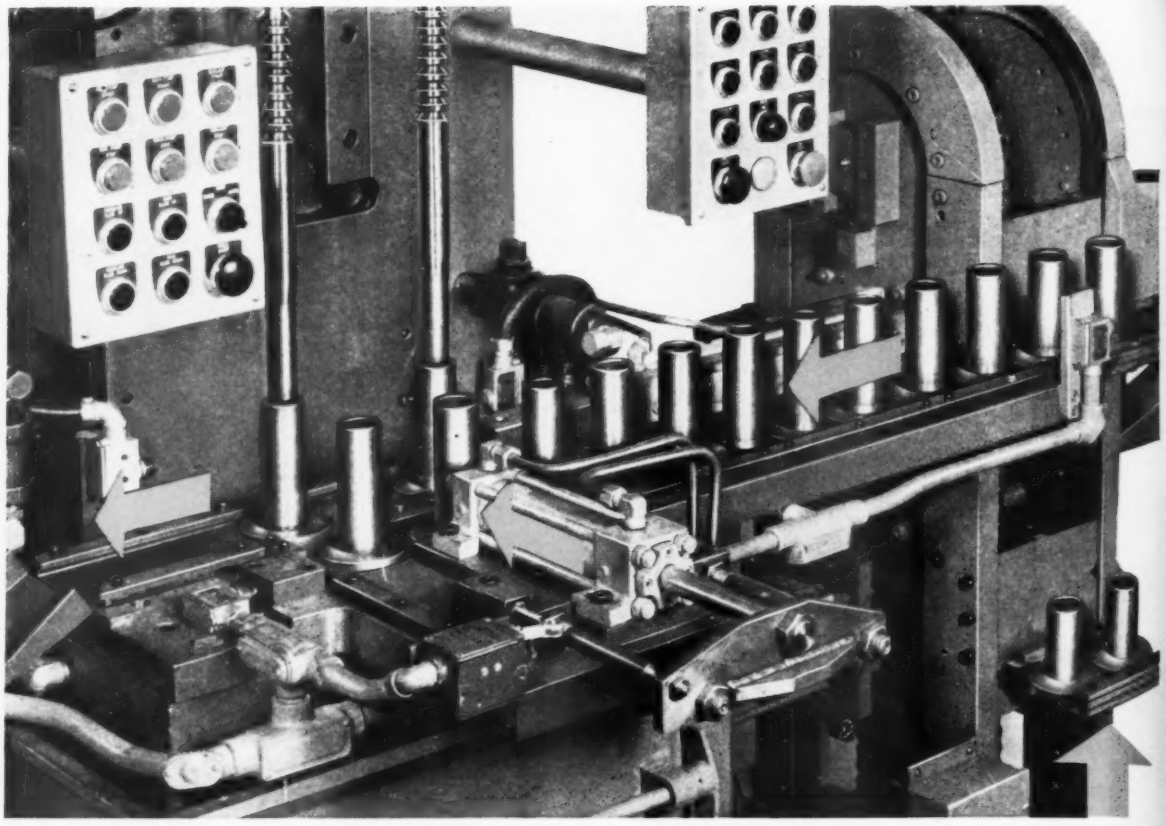
Production: Cycle time 8.55 seconds per piece, 421 pieces per hour gross.

Why not put your high-volume, high-precision jobs on Baird 76H Chuckers? Even where volume is not the whole story, rapid-tooling change-over makes it a most profitable investment. Estimates and recommendations will be given on your prints or samples. Write Dept. TP

Interested in Deferred Payment? . . . "ask Baird about it."

THE BAIRD MACHINE COMPANY
STRATFORD CONNECTICUT

9BA56



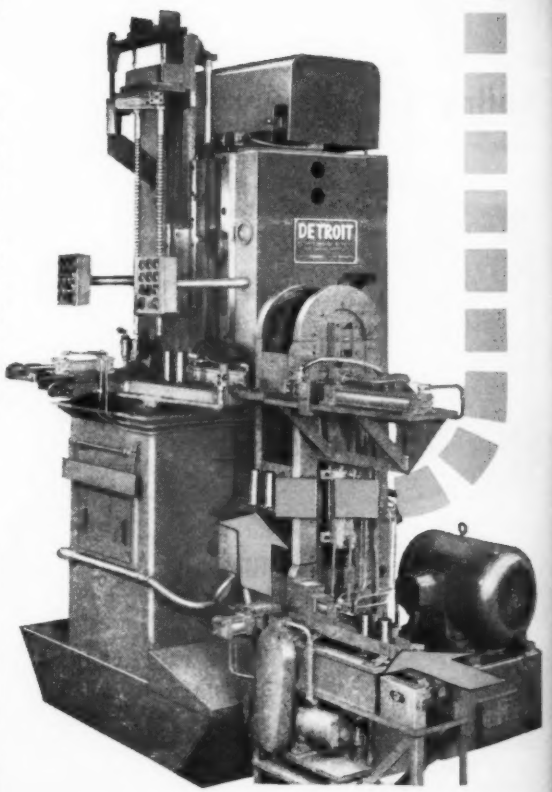
STANDARD Broaching Machine Tooled for AUTOMATION

This broaching setup on a Detroit 15-ton, 42-inch Vertical Pull Down Machine illustrates *practical* automation! It combines the economy of a standard machine, readily retooled for production changes, with a special work handling system that makes floor-to-floor operation fully automatic.

Flanged work pieces are loaded at floor level, conveyed to an elevator, raised, pushed off and shuttled into broaching position, broached and unloaded . . . all without an operator. Each broaching stroke sizes the I.D. and removes excess welding at the flange joint. Parts are handled as fast as they can be supplied by the "automatics" ahead of this operation.

The same broaching specialists who created this productive combination of "standard and special" can help solve *your* production problem. Send parts, prints or details now.

Write for bulletin describing Detroit Vertical Pull Down Machines.



DETROIT BROACH & MACHINE COMPANY

DEPT. E-2 • ROCHESTER, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 28

AVOID the **HIGH COST** and difficulty of fabricating long, hard & straight parts by conventional methods . . .

THOMSON

60 Case

hardened and ground

SHAFTS, ROLLS, GUIDE RODS and other long-round parts

60 Case is the result of over ten years of experimental work and production experience with hardened and ground shafts which are a requirement for BALL BUSHINGS, the Linear Ball Bearing manufactured by Thomson Industries, Inc.

The special techniques and equipment that have been developed enable high production rates and low handling costs. This permits big savings over conventional methods which are plagued with erratic warpage, straightening and resultant grinding problems. Finished *60 Case* parts frequently cost less than the scrap losses that result from conventional methods.

60 Case material has a surface hardness close to 60 on the Rockwell C scale which is essential to resist wear.

Long lengths of material ranging in diameter from ¼" to 4" are stocked to enable prompt shipment of *60 Case* parts, with or without special machining.

Write for literature and name of your local representative.

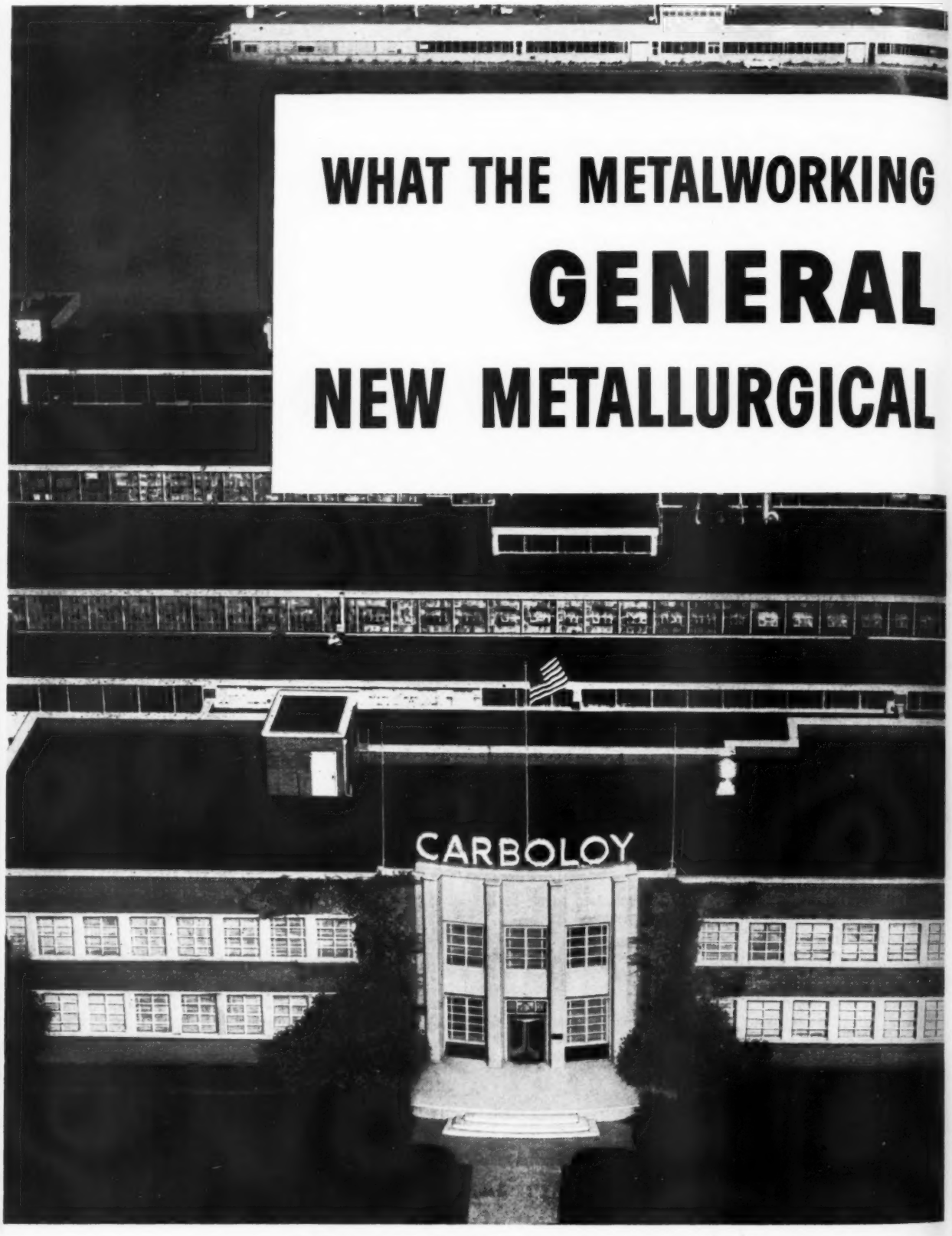
ADVANTAGES of *60 Case*

- COST REDUCTION
- HARD BEARING SURFACE
- ACCURATE DIAMETERS
- GROUND FINISH
- STRAIGHT PARTS
- DELIVERY FROM STOCK
- ADDED STRENGTH
- UNIFORM HIGH QUALITY

TYPICAL *60 Case* PARTS

GUIDE RODS, SHAFTING, ROLLS, TRAVERSE RAILS, PISTON RODS, ARBORS, LEADER PINS, TIE RODS, KING PINS, AXLES, CONTROL RODS, GUIDE POSTS, MANDRELS, BEARING ROLLERS, SPINDLES

THOMSON INDUSTRIES, Inc.
Dept. C1, Manhasset, New York



Headquarters of the Metallurgical Products Department of General Electric Company, 11111 E. 8 Mile Ave., Detroit 32, Michigan. Carboloy Cemented Oxide and carbides are made here. G-E permanent magnets and specialty resistors are manufactured in the Edmore, Mich., plant.

INDUSTRY CAN EXPECT FROM ELECTRIC'S PRODUCTS DEPARTMENT

The new G-E Metallurgical Products Department is the successor to the Carboloy Department. Here's what this change will mean for you.

Since 1928, the General Electric trademark "Carboloy" has been identified with a brand of cemented carbide. But today, Carboloy® cemented carbides are just one of a broad range of products which bear the famous Carboloy trademark.

Cemented Oxide, the Machinability Computer, toolholders, diamond dressers, drawing and forming dies . . . these are on the market today. Tomorrow, you will see many other new-product developments for the Metalworking Industry.

With carbides like the new Extra-Performance Series 300 steel-cutting grades, these products are being made available to you through a distribution team which is unmatched in the carbide industry from the standpoint of inventory, delivery, and service.

In addition, the Metallurgical Products Department makes other products which carry only the General Electric trademark: permanent magnets, vacuum-melted alloys, hevimet, thermistors, and Thyrite® varistors. And on the industrial horizon are G-E man-made diamonds.

Thus, the new departmental name symbolizes the broadened scope of this Department's activities. Equally important, it indicates how vitally interested General Electric is in the Metalworking Industry.

Many of the products listed above are the result of fundamental investigations carried out at the G-E Research Laboratory in Schenectady. Many new developments in machining, forming, and drawing techniques are the work of G-E Engineers. And, when new products and methods are developed for the Metalworking Industry by General Electric, they, too, will come to you from the Metallurgical Products Department.

Progress Is Our Most Important Product

GENERAL ELECTRIC

CIRCLE INFORM-A-GRAM KEY NO. 31

let rockets rise
but
KEEP
STAMPING
COSTS DOWN!
. . . and here's how
If a rocket goes sky-high it's probably okay with everyone. But if production costs shoot up out of range, all heck breaks loose.
This is where Laystrom can help you. We can give you a cost-saving approach to many of your stamping problems. This involves proper tooling, the right presses for each different type of job, and a skill and knowledge of metal forming based on 40 years' experience.
There's no better place to put your stamping problems than in our hands. We'll work with you until a solution is reached that will keep costs on the ground and put new beauty in your profit picture. Send us your drawings today.
LAYCO
Laystrom
TOOLS • DIES • ASSEMBLIES • PARTS DESIGN • SHORT-RUN DUPLICATING
PRECISION MACHINING OF MEDIUM SIZE STAMPINGS AND CASTINGS
LAYSTROM MANUFACTURING COMPANY
2005 North Parkside, Chicago 39, Illinois
• Please send us complete brochure covering Laystrom production services to industry.
Name
Title
Company
Address
City State
We are sending drawings for quotation.
Have salesman call.
Send brochure only.
CIRCLE INFORM-A-GRAM KEY NO. 32

. . . Who Hires? from page 26

they talk about others. Were all of his ex-bosses mean, ornery critters that were always down on him? Were they dopes over whose eyes he always pulled the wool? You can find out much about how well he has liked the job with other workers by asking him to tell you about the people he worked with at his last two or three places of employment.

10. Record your reactions. Human memory is short lived and very faulty. If two or three days elapse between interviews, your mental picture of the first man will be pretty hazy before you get around to interviewing the second. One or two points which may or may not be of any great importance will stand out, but you will lose the balance picture of the man that you developed while you were talking with him. If you interview half a dozen men for the same job, they will tend after a very brief period to get more or less mixed up in your mind. It's even a wise move to jot down notes of specific importance during the course of the interview. It's surprising how they can elude you even at the end of a half hour. If you do a great deal of interviewing for the same or similar jobs, it may be worth your while to develop a standard interview report form so that you will have a standard basis of comparison from man to man. If you interview only occasionally, the major headings of your interview outline may serve to help you make sure that you cover all the important points in preparing a summary of your findings.

Next to the application blank the selection interview is probably the most frequently used industrial selection tool. Its importance grows with the level of the position that the applicant is seeking. To conduct a good selection interview takes time and a little self discipline, but the selection function is an important one. It's there that most personnel problems begin. The time spent in the content of a well planned and systematic interview will usually pay high dividends.

NECROLOGY

Edward L. Parker, chairman of the board of Columbia Steel and Shafting Company of Carnegie, Pa., at Ft. Lauderdale, Fla.

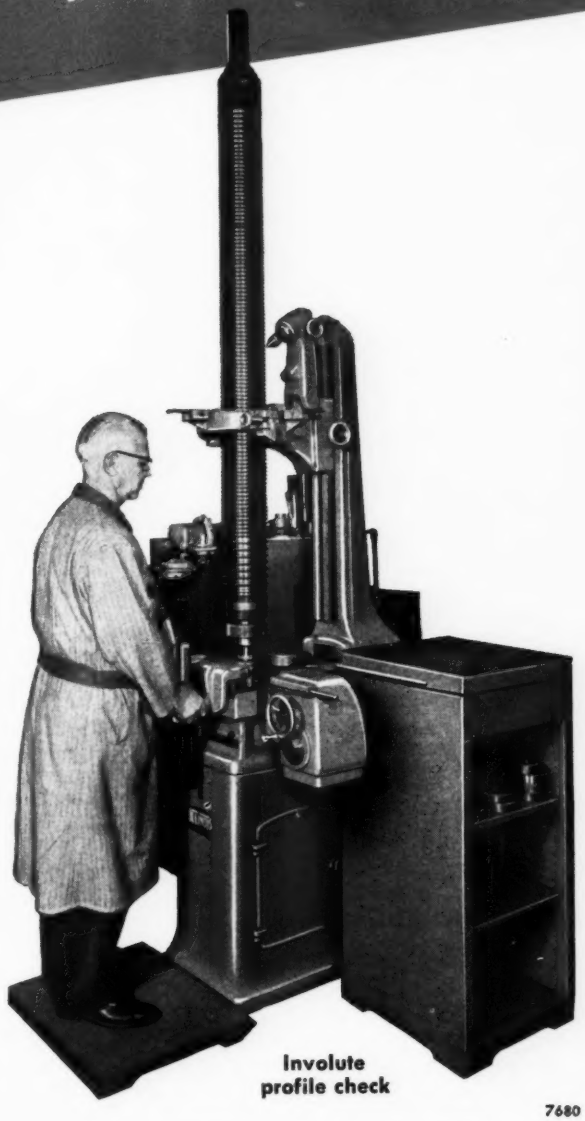
Victor Mauck, 82, retired chairman of the boards of the John Wood Company and Nicolet Industries, Inc., of Philadelphia.

WHY YOU GET BETTER HIGH SPEED INTERNAL GEARS AT MINIMUM COST WITH RED RING NALOY BROACHES

- Gear is completely cut from the solid blank in just one pass. A quick shaving operation or a finish broaching pass completes it.
- Critical gear characteristics held to tolerances of .0002".
- All gears produced are interchangeable regardless of the number of broaching tools in use.

The secret of combining spectacular economy with such high gear precision lies in the broaching tools themselves. Special manufacturing processes are used. Each is under the constant control of Red Ring metallurgists and engineers in this company's own plant.

The real proof of Red Ring methods is reflected in actual performance figures. Ask to see them.



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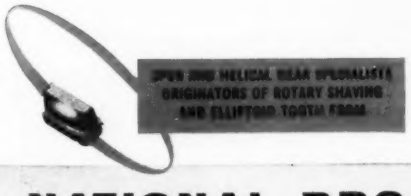


NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

CIRCLE INFORM-A-GRAM KEY NO. 33

Consider your press operator when you consider an O.B.I.

We've talked to a lot of press operators about our Clearing O.B.I.'s. "We like them," they tell us, "they're easy to run. Quiet. And you have a feeling that they can't go wrong on you." Frankly we listen real good to a press operator because he can tell us a lot about our equipment. In fact, the safety designed into our O.B.I.'s—the simple cleanliness of the design, the accessibility of controls—these things were figured from the needs of the man running the machine.

The quiet operation that operators like—well that's just a function of fine construction of Clearing O.B.I.'s. Sort of a bonus factor you might say. Next time you see a fellow running a Clearing O.B.I., ask him how he likes the machine. It's an important point. An operator who likes his equipment will do a better job. If he feels safer, his morale is better. These things mean improved production, a happier shop. And a happy shop is usually a profitable one.

Find out why people prefer Clearings. Write for our fact-filled catalog. No obligation.

CLEARING PRESSES THE WAY TO EFFICIENT MASS PRODUCTION

CLEARING MACHINE CORPORATION

6499 WEST 65th STREET • CHICAGO 38, ILLINOIS • HAMILTON PLANT, HAMILTON, OHIO

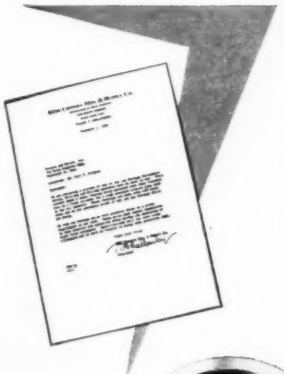
Division of U. S. INDUSTRIES, INC.

CMC CLEARING

CIRCLE INFORM-A-GRAM KEY NO. 34

Photo courtesy 20TH Century Mfg. & Supply Co., Tulsa, Oklahoma

"We are extremely proud of the job our PORTAGE mills are doing"



The Portage Machine Co.
Akron, Ohio

Gentlemen:

Our business, as you know, is Contractors of Metal Products. This particular job is a steel forging being machined, and when finished will be a fluid cylinder for a high pressure pump used in the oil industry. These forgings are made from AISI-4140 steel and we are extremely proud of the job PORTAGE mills are doing.

We find our PORTAGE mills very accurate. These mills must repeat themselves in each location and operation often during the machining operation. Specifications call for very close tolerances and we have no trouble in doing this precision work.

Yours truly,
20TH Century Mfg. & Supply Co.

R. G. Galloway
President

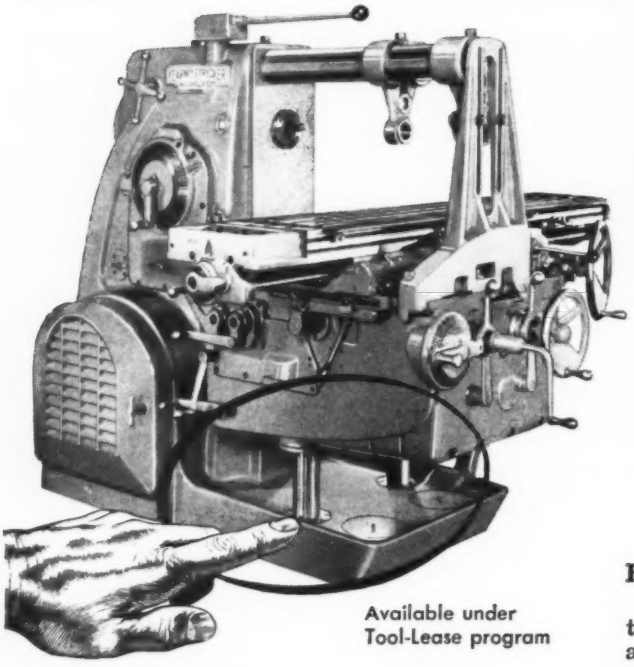
THE Portage MACHINE CO.

1046 Sweitzer Avenue • Akron 11, Ohio
Representatives in Principal Cities

BUILDERS OF PRECISION MACHINE TOOLS, SPECIAL AND PRODUCTION MACHINERY SINCE 1916

CIRCLE INFORM-A-GRAM KEY NO. 35

COMMON SENSE says it's better...



Available under Tool-Lease program

Twin Screw Knee Support

Think it over . . . twin screw knee support is the one really new basic advancement in knee type milling machine design in years. And only Kearney & Trecker new TF Series machines have it!

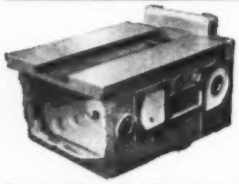
Here's why it makes sense.

Because the *twin screw* design distributes most effectively the weight of much larger, heavier knees, saddles and tables, it fulfills today's requirements for higher speeds, feeds and power — greater machine capacity. What's more, this *balanced design* substantially increases stability under heaviest loads . . . offers greater resistance to torsional thrust under all cuts . . . divides the wear factor in half, thus assuring greater, longer-lasting accuracy.

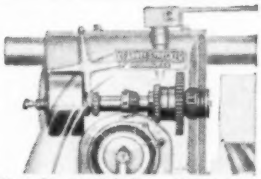
Kearney & Trecker's feature-packed TF Series line of general production machines is available in five sizes — No. 2 to No. 6, from 10hp to 50hp in Plain, Universal and Vertical styles.

Why take less than the latest when you want new milling machines? You can get all the facts on the new TF's from your Kearney & Trecker representative, or write direct to Kearney & Trecker Corp. Mail coupon for new catalog with details on TF Series machines.

5 more reasons why TF Series milling machines are way out front in rigidity

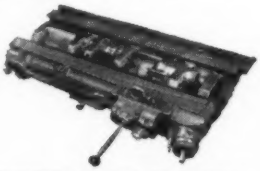


Heavier, Wider, One-Piece Knee — The TWIN SCREW arrangement supports the heavier, larger knee. Span and length of ways is increased considerably, providing fuller saddle support . . . lasting accuracy . . . substantial reduction of way and gib wear.



Three-Bearing Spindle — Complete assembly consists of three heavy-duty bearings, flywheel, a train of wide-faced forged steel gears. Rigidity of spindle unit contributes to increased cutter life, better finish and quieter operation.

Double "Vibra-Void" Overarms — Two solid steel bars, mounted completely through column, void vibration at source, afford more rigidity and resistance to deflection than any other type support. Design also greatly simplifies changing of arbors and cutters.



"Fron-Trol" Operating Convenience — Front-mounted controls include feed selection, Mono-Lever table feed and rapid traverse, automatic cycle table feed and rapid traverse controls, table handwheel, saddle clamping gib and backlash eliminator. Machines have 2" dia. table feed screw.

Massive Column — Solid back, double-box section column is scientifically ribbed throughout to rigidly withstand heaviest cutting forces. Full bearing column face affords maximum support for the knee. Cross-mounted motor assures maximum ventilation, easy access for routine maintenance.

KEARNEY & TRECKER MILWAUKEE ®

BUILDERS OF PRECISION AND PRODUCTION MACHINE TOOLS SINCE 1898

KEARNEY & TRECKER CORP.
6776 W. National Ave., Milwaukee 14, Wisconsin

Please send me Catalog No. TF-50 with details on new line of TF Series Plain, Universal and Vertical milling machines.

Name.....

Title.....

Company.....

Address.....

City.....Zone.....State.....

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Scott Machine Tool Co.
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19 West 10th Street

WICHITA, KAN.
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WINDSOR
Williams & Wilson Ltd.

KEARNEY & TRECKER MILWAUKEE

CIRCLE INFORM-A-GRAM KEY NO. 36

FILMS TO SEE

Electrostatic spray painting is covered in the movie, "The Big Attraction." Actual production line shots in both large and small plants show how big savings in paint, labor, equipment, and floor space are being provided by the Ransburg No. 2 Process. The advantages of the process are brought out by this case history style of presentation. To obtain a copy of the 30-min, 16 mm color and sound film on a free-loan basis, contact Ransburg Electro-Coating Corp., Barth & Sanders St., Indianapolis 7.

"The Science of Making Brass," a 16 mm color movie, explains the step by step process of making brass and other copper alloys in the forms of sheet, rod, wire and tube. Close-up pictures show casting, extruding, piercing, drawing and rolling operations. This film takes the viewer on a 29-min tour of the mills of Chase Brass & Copper Co. in Waterbury, Conn. To arrange for a free loan of the film, write to Modern Talking Picture Service, Inc., 3 E. 54th St., New York 22.

Two color movies on rotary head milling have been released by Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14. They are "From Print to Product" and "The Little Showoff." These films present typical examples of the benefits of Model D rotary head milling machine and the Tri-D milling head.

Jig grinding on a jig borer is detailed in a black and white sound movie which is loaned free of charge by The Vulcan Tool Co., 730 Lorain Ave., Dayton 10, O. The film, "Low Cost Jig Grinding," shows the ease with which a jig borer can be converted to jig grinding in a few seconds. Many scenes are included other than jig grinding on a jig borer, such as its use as a high speed, precision grinder on lathes, boring mills, internal grinders and mills.

"Progress in Precision" deals with the factors involved in the generation of precision functional surfaces. The movie points out that there must be a means of communication to describe the characteristics specified by the design engineer and which can be interpreted by the mechanic who creates the surface. In addition, it shows that methods and tools must be created to aid the mechanic in performing his task, and devices must be available to measure and evaluate the characteristics of the surfaces created. Copies of the film are available on loan from Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38.

new
FORD
solid carbide
END MILLS

WHY THEY DO YOUR JOB BETTER

All Ford end mills are *precision machine ground from the solid* . . . which insures uniformly accurate flute form and a constant relief angle. On your job, that means more parts per grind. So you save labor on grinding and tool changing. You save on replacements. You save on downtime. What's more, there's less time per part, more parts per hour, fewer rejects. Available in 11 types . . . all standard, and *available.*

Rotary FORD Tools

BULLETIN 510 FREE AND LATEST PRICES . . . WRITE TODAY

M. A. FORD MFG. CO., INC.
817 W. RIVER STREET
DAVENPORT, IOWA

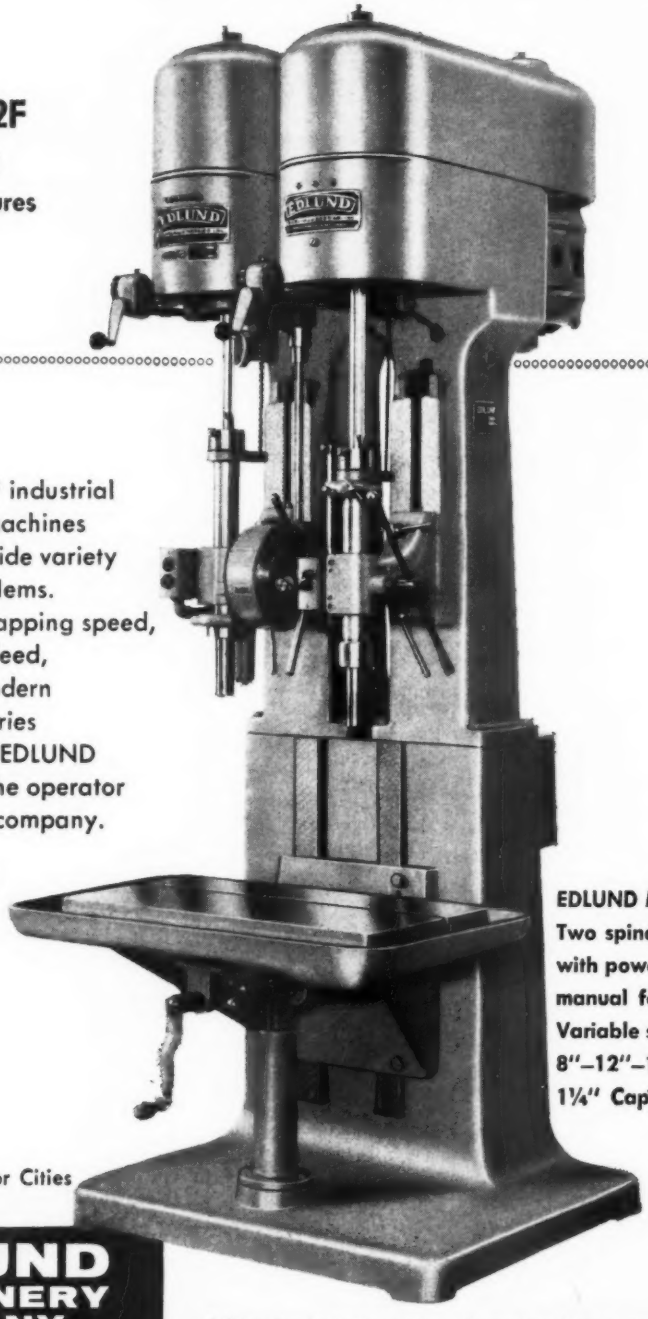
Precision manufacturer of H.S.S. and Carbide Rotary Files and Cutters • Countersinks • Grinding Burrs • Special Tools • Factory Regrinding

CIRCLE INFORM-A-GRAM KEY NO. 37

EDLUND AMERICA'S MOST VERSATILE DRILLING MACHINE

EDLUND Model 2F

Infinitely Variable Speed
Modern Production Features
Long Lasting—
Rugged Construction



The changing pattern of industrial production requires machines readily adaptable to a wide variety of production problems. Selection of **any** drilling or tapping speed, manual or power feed, and many other modern production accessories make operation of the EDLUND Model 2F a pleasure for the operator and good sense for the company.

Write for Bulletin 140R.

EDLUND Model 2F
Two spindle combination with power feed and manual feed.
Variable speeds to 3600 rpm
8"–12"–15" Overhang
1¼" Capacity

EDLUND Representatives in Major Cities

EDLUND MACHINERY COMPANY
Cortland, New York
Division of Harsco Corporation

Write for Bulletin G56 — Complete Line with Cam Feed Units
Bulletin 160 — Model 1F–High Speed
Bulletin 170R— Model 4F–Production

CIRCLE INFORM-A-GRAM KEY NO. 38

The above preformed tungsten carbide parts (shown unfinished) required little work after sintering.

You can save time and money by using preformed carbide parts*

**. . . Valenite carbide preforms reach you faster — require far less finishing before they go to work!*

Here's Why . . .

1. Through Valenite's advanced production techniques, you get premium-grade carbides (and premium performance) at no increase in price over regular carbides

2. Valenite gives you closer tolerances on preformed parts. You cut grinding and finishing time and expensive diamond wheel usage

3. At the new Valenite plant, your preformed carbide parts go into production at once — without red tape delays in the office

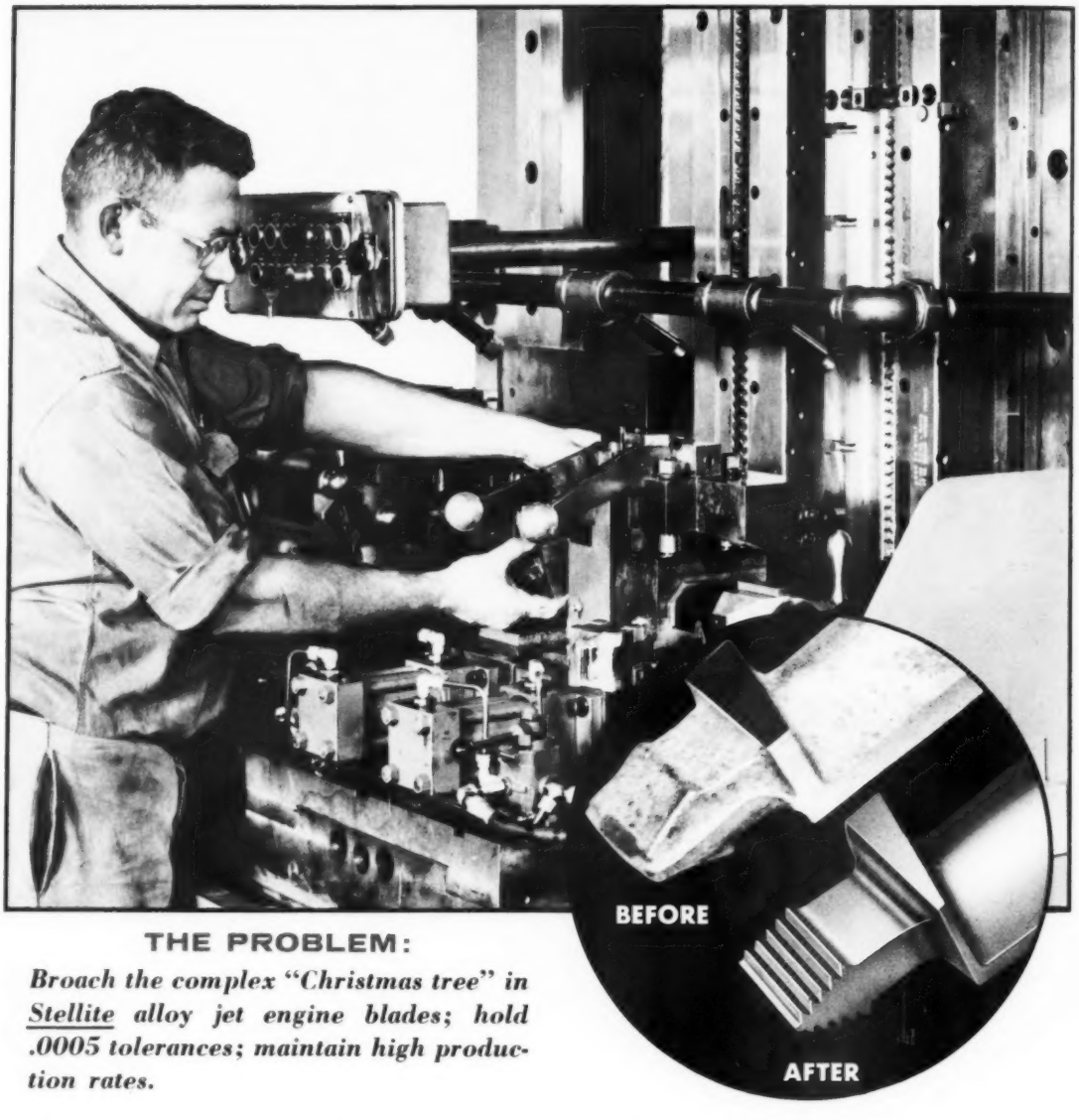
4. Valenite maintains a staff of specialists in carbide preforming. Their assistance will save you money, give you improved on-the-job carbide performance

Maybe you can save money *right now* on your carbide preforms, or profitably use preforms in place of modified standards. Why not send your prints to Valenite for study, recommendations and a quotation? Or ask for your Valenite field man to call.

Write to:
TECHNICAL SERVICES DEPARTMENT

VALENITE
METALS CORPORATION
Box 205, Royal Oak, Michigan

Solved – a tough broaching problem!



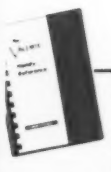
THE PROBLEM:

Broach the complex "Christmas tree" in Stellite alloy jet engine blades; hold .0005 tolerances; maintain high production rates.

Conventional broaching tools failed to do the job and were worn out after only a few passes through this tough material. But, by using rugged equipment, an ingenious tooling setup, and Valenite vacuum-sintered carbide on the broaches, Detroit Broach and Machine Company, of Rochester, Michigan, solved the problems of this "impossible" job.

Say Detroit Broach engineers: "Broaches tipped with Valenite carbide hold up amazingly well on the jet blade job. Also, the preformed carbide blanks arrive at our plant exceptionally close to finished dimensions, thus our finishing work is cut to a minimum. Our customer is pleased with the results we were able to give him on this job; we are pleased with Valenite quality and service."

Maybe you have a tough machining job in your plant where VALENITE carbide can cure production headaches. And remember . . . you get faster delivery on money-saving preformed carbide parts from Valenite!



FREE . . . your copy of the Valenite Handy Reference. Packed with useful tables and formulas. The most useful book of its kind. Write for your copy (on your company letterhead, please.)

VALENITE®
METALS

Division of the Valeron Corporation
Box 205 • Royal Oak, Michigan

"Commendable Comments"

"Industrial long-range planning is a management tool or technique in which research provides a factual framework so that significant decisions can be made on the basis of long-range considerations rather than on the basis of expediency."

—Charles L. Hamman, assistant director of economics research, Stanford Research Institute at the American Industrial Development Council's 31st annual meeting in San Francisco.

"The machine tool industry provides now nearly one-twelfth of the $12-billion worth of new and replacement equipment that must go into manufacturing industries each year to equip our current labor force, boost productivity, and keep manufacturing costs at economical levels in the face of rising labor and material costs."

—James C. Kelley, general manager of the American Machine Tool Distributors' Association, at a mid-eastern regional meeting.

". . . management is going to witness a tremendous and continuing advancement in the science of forecasting and a growing dependence on forecasts of economic conditions, general business, and sales by companies of every size. But this dependence . . . must never dull a feeling for facts and the use of that priceless ingredient of successful management: good common sense."

—Ben F. McClancy, general manager of The Associated Industries of Cleveland, in a recent AI newsletter.

"Save by exploitation of loopholes and palliative devices, the economy cannot find a solid basis for stable growth without income tax rate reforms. The present steep progression, as personal income levels rise, will progressively suffocate the economy as a whole just as it already is suffocating opportunities for the singularly gifted and skilled individual. Tax reforms need to be specifically patterned to induce more creation of equity or risk capital. Tax laws as they stand unduly prejudice business judgments in favor of borrowed money, and that is one of our troubles."

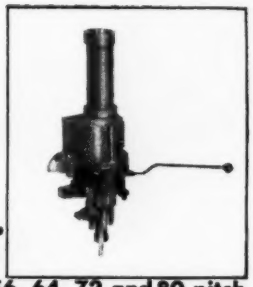
—Norris O. Johnson, vice president of The First National City Bank of New York, at the recent Annual Meeting of the American Finance Association.

"Electronic computers in the future will enter more directly into the production field. They will be used to control processes and coordinate various departments, as well as work out optimum stocks of material and work in progress. Master controllers might even take into account external problems such as changes due to seasonal demands."

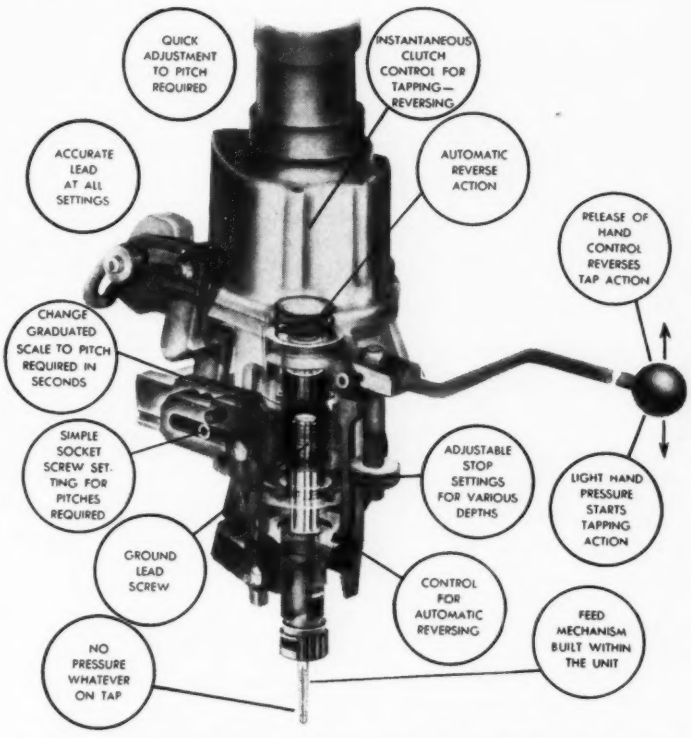
—Ralph V. Coles, general manager of the Fielden Instrument Division of Robertshaw-Fulton Controls Company, at a Pittsburgh branch meeting of the National Industrial Advertisers Association.

NEW Jarvis adjustable pitch LEAD SCREW TAPPER!

2 models. . .



Convertible to 11, 12, 13, 14, 16 18, 20, 24 and 28 pitch . . . 24, 28, 32, 36, 40, 44, 48, 56, 64, 72 and 80 pitch in SECONDS!


QUICK ADJUSTMENT TO PITCH REQUIRED
INSTANTANEOUS CLUTCH CONTROL FOR TAPPING—REVERSING
ACCURATE LEAD AT ALL SETTINGS
AUTOMATIC REVERSE ACTION
RELEASE OF HAND CONTROL REVERSES TAP ACTION
CHANGE GRADUATED SCALE TO PITCH REQUIRED IN SECONDS
SIMPLE SOCKET SCREW SETTING FOR PITCHES REQUIRED
ADJUSTABLE STOP SETTINGS FOR VARIOUS DEPTHS
LIGHT HAND PRESSURE STARTS TAPPING ACTION
GROUND LEAD SCREW
CONTROL FOR AUTOMATIC REVERSING
FEED MECHANISM BUILT WITHIN THE UNIT
NO PRESSURE WHATEVER ON TAP

Now, one attachment, one lead screw with quick simple adjustment gives convertible tapping in Seconds! Through positive leverage and clutch control, one lead screw running at constant speed, makes these new adjustable pitch lead screw tappers a must in every tapping department.

This is production economy—saves the cost of individual lead screws for each pitch desired. Saves change over time—converts in a few seconds—by adjustment of four set-screws along a clearly marked graduated scale.

Tap with a feather touch on hand control . . . no pressure on the tap. Stops cut at end of predetermined depth. Automatically reverses upon release of hand control, automatically backs out, leaving clean, accurate threads.

Now, convertible pitch tapping, faster production, new versatility is assured even by unskilled operators—with this tapping attachment.

WRITE NOW! Send for bulletin and prices.

Jarvis CORPORATION
POWER TOOLS FOR INDUSTRY
MIDDLETOWN, CONNECTICUT

CIRCLE INFORM-A-GRAM KEY NO. 41

COMPUTERS — THEIR OPERATION AND APPLICATIONS, by Edmund C. Berkeley and Lawrence Wainwright. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y., 1956. 366 pages, $8.

Developments in automatic computing techniques and equipment are described, illustrated and compared in this book. Chapters tell how automatic digital computers, automatic analog computers, miniature computers and other types of automatic computing machines work and what they can do. Computer reliability, advantages, limitations and maintenance are also considered.

Valuable features include a chapter on present and potential applications; a checklist of computer characteristics; a listing of books, periodicals, papers and organizations offering additional information on all aspects of computing machinery; names and addresses of organizations from whom automatic computing equipment may be bought or rented; and a large glossary of terms and expressions used in the automatic computing and allied fields.

ELECTRICAL TESTING AND TROUBLESHOOTING, by Philip T. Green. Published by The Industrial Press, New York 13, N. Y., 1956. 200 pages, $4.

This book presents procedures for electrical testing and troubleshooting that have been used in the field by men responsible for installation and maintenance of electrical equipment. It covers a variety of methods of testing and correcting faults in circuits of all kinds including controllers, motors, transformers and transmission lines.

After a simplified briefing on how to understand electrical symbols and drawings, subjects treated include analyzing and charting controller operation, troubleshooting test equipment, insulation testing, locating grounds, electromagnet windings, dc machine windings, simple phase transformers, phase sequence, polyphase transformers, induction motors, synchronous motors, power cable faults and bearing lubrication.

Most of the tests described are performed with the equipment isolated from the power line. Current for testing is supplied by dry cells or residual magnetism so that accidental contact or short circuits are less hazardous for men and machines.

NATIONAL STANDARDS IN A MODERN ECONOMY, edited by Dickson Reck. Published by Harper and Brothers, New York, 1956. Available from American Standards Association, Dept. P-1, 70 E. 45 St., New York. 372 pages, $5.

Thirty-four leaders in the private and public organizations that have developed modern standards have contributed chapters to this definitive review of the evolution of industrial standards and their place in the world. They link standards with the achievements of scientific research and technological innovation that bring about high production efficiency in the age of automation. They also discuss the vital role of standards in a variety of fields such as interchangeable parts manufacture, international relations, quality control, management and research and development.

Among the authors are former president Herbert Hoover; Howard Coonley, formerly president and chairman of the board of Walworth Company; and Thomas D. Jolly, vice president of Aluminum Company of America.

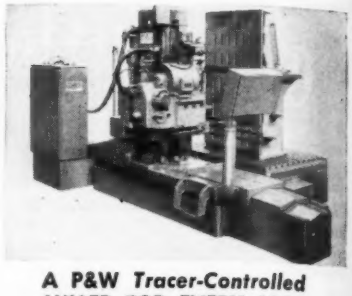
Three sectional headings divide standards history into "The Movement Toward National and International Standards," "Liberating Initiative and Productive Forces by Applying Standards," and "Some Implications of the Use of National and International Standards."

NEW CARBIDE GRADE FOR CAST IRON AND BRASS MACHINING

A recently developed carbide tool grade is particularly recommended for machining cast iron, aluminum, brass, and plastics. West Coast manufacturers of aluminum alloy aircraft parts have reported outstanding success with this new Firthite NHA, produced by Firth Sterling Inc., on all types of applications.

One manufacturer conducted a test using NHA and several other grades of carbide to mill a test piece of Dural-75 ST measuring 12" long and 2" wide. NHA proved superior to all other grades tested because of only a 0.005" wear land after 10 cuts and because of its excellent twisting and brazing qualities.

A manufacturer of drilling rigs recently ran a test using NHA and three other grades of carbide to turn, bore and face a clutch center plate. NHA gave 20 pcs/point on a trial run of 50 blanks, or exactly twice as many pieces as the best of the other three carbide grades.



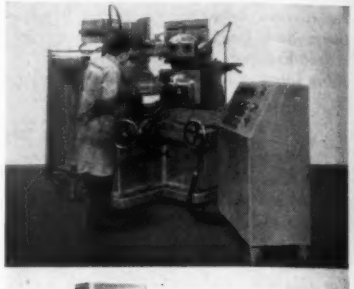
A P&W *Tracer-Controlled* MILLER FOR EVERY JOB

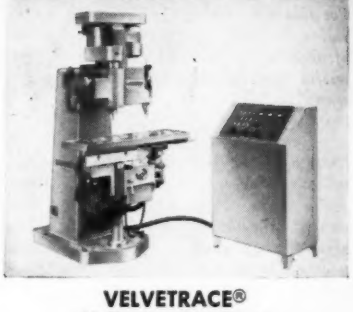
KELLER Type BG-21

... A powerful, versatile machine made in a range of sizes from 5' x 2½' to 10' x 4' in single spindle or 2-spindle models.

KELLER Type BL

... A compact powerful Tracer-Controlled Miller for work within the range of 36" x 20", with all the new KELLER features. Single spindle and 3-spindle models.



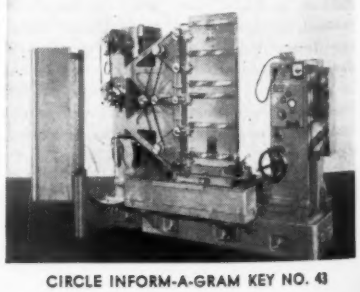


VELVETRACE® Kellering Machine

... Duplicates the finest detail with extreme precision. New, non-contacting tracer accurately follows any 3-dimensional model without touching it. Cannot damage the softest, most fragile models.

Automatic Duplicating Machine

... Specially designed for low cost production of forging dies and molds for glass and plastic. Automatically re-produces original dies and molds with precision and remarkable detail. There are two versions of this machine, one for machining bottle molds, one for forging dies. Supplied with 1, 2 or 4 cutter spindles.



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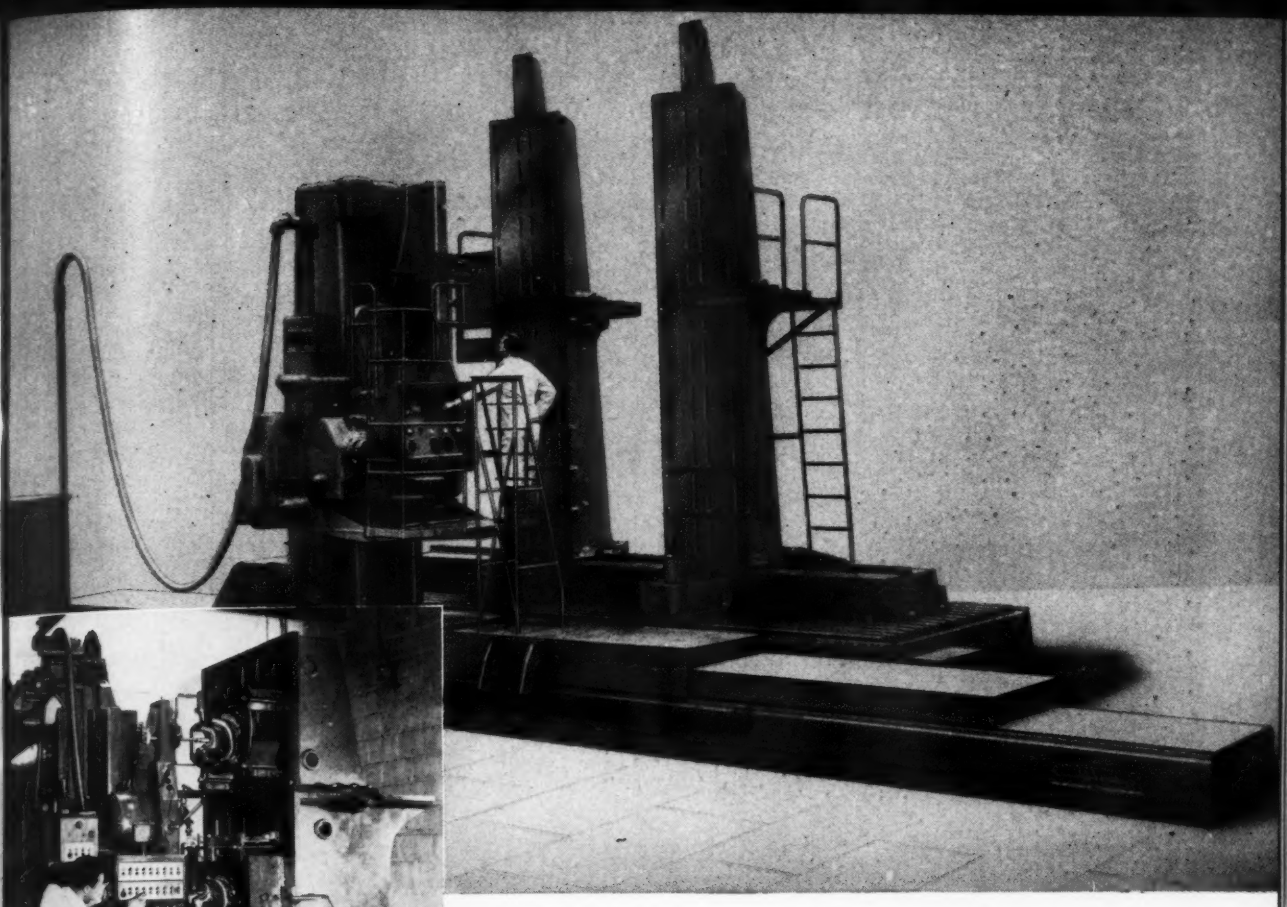
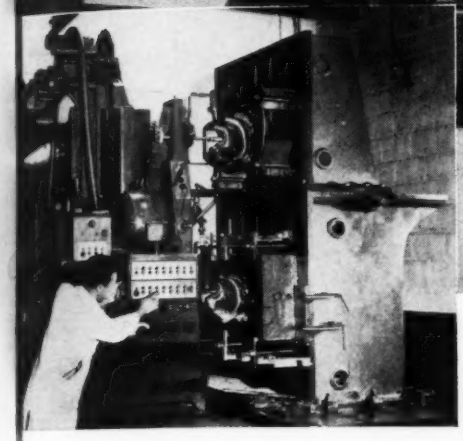




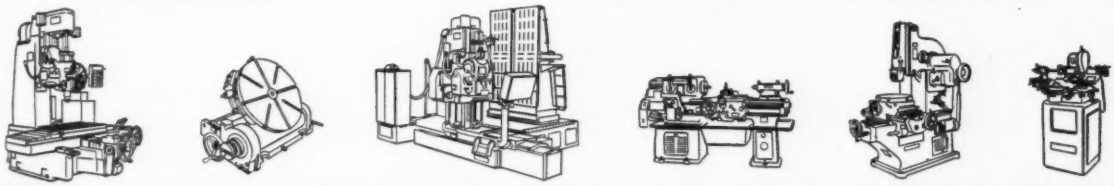
Still Running Fine, BUT

TODAY'S KELLERS WILL BRING EVEN GREATER PROFITS.

You may put off replacing an older machine because "it's still paying its way." But is it? A machine tool purchased years ago may be the cause of lost efficiency, higher labor and per-unit costs, the inability to produce high quality *economically.* Failure to compete profitably with more modern machines may be putting you far behind your competitors. For example, just 10 short years ago our Keller BG-2 Tracer-Controlled Miller was the ultimate in productive efficiency, but let's check the added features possessed by its successor, the new P&W BG-22 Keller . . .

1. Operates from any conventional polyphase current, with no motor generator set required.
2. Increased travel speed of cutting tool . . . to an infinitely variable range from 0.5 to 30.0 inches per minute.
3. Three dimensional tracer permits motion in 2 directions at the same time, yet allows interlocking action for accuracy. One slide is kept always in motion, while the second moves as required to follow the shape and maintain accurate interlocking action.
4. More nearly perfect surface cutting speed over irregular contours assured through superimposed auto-speed control of all motions.
5. Increased capacities . . . up to 20 feet horizontal x 7 feet vertical.
6. Centralized operator controls supplemented by remote control stations.
7. Rapid traverse in all three motions.
8. Automatic lubrication.
9. Score-proof phenolic bearing surfaces on all slides and lead screw nuts.

Write for complete information.
Pratt & Whitney Company, Incorporated
15 *Charter Oak Boulevard, West Hartford, Conn.*



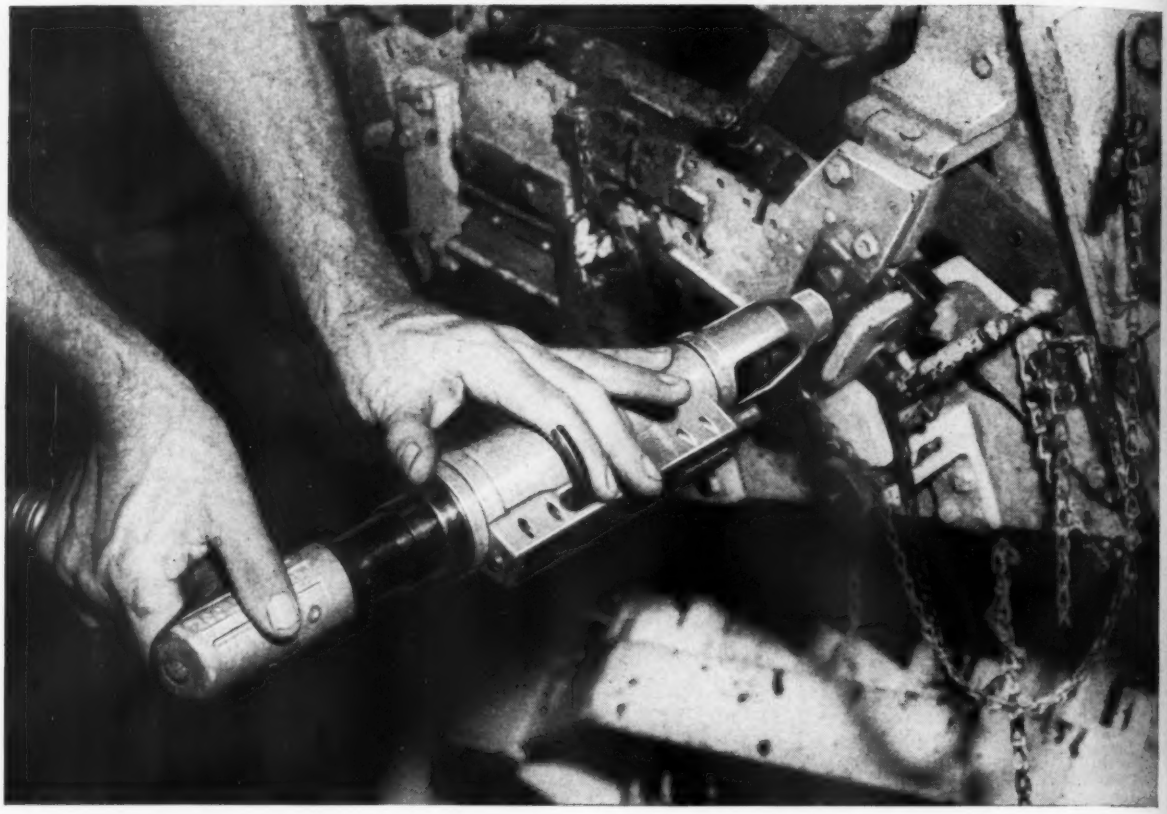
JIG BORERS . . . ROTARY TABLES . . . KELLER MACHINES . . . LATHES . . . VERTICAL SHAPERS . . . CUTTER AND RADIUS GRINDERS

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS

Gardner-Denver . . . Serving the World's Basic Industries



Keller NEW Hard Metals Portable Tool Drills Holes Cleanly at Any Angle

Here is the Keller Tool "K-MATIC"* *portable* production line drilling unit that embodies the best features of an automatic precision drilling machine and the handy hand drill!

This air-powered unit drills clean, true holes in titanium, heat-treated stainless steel and other hard metal alloys—*on the production line.*

Features of the "K-MATIC"

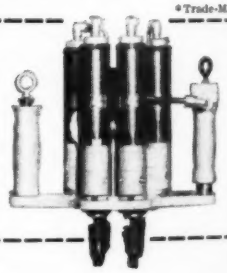
- Handles drills up to 3/8".
- Positive differential lead screw prevents plunging on break-through.
- Drills sandwich construction with uniform penetration.
- Drills so cleanly that reaming is often unnecessary.
- Drill bit returns automatically, quickly.
- Single-lever operation—requires no special operator skill or training.
- Adjustable stop prevents "drilling air."
- Instant bit return prevents damage during drilling cycle.
- Develops up to 1000-lb. thrust.
- Light in weight—"K-MATIC" attachment weighs under 5 lb. . . . is only 12" long, with 1¼" stroke length.

For complete information and specifications, write Gardner-Denver Company—Keller Tool Division, Grand Haven, Michigan.

* Trade-Mark

Another new time saver . . . cost shaver!

Keller Tool multiple-spindle, medium-torque (2 to 24 foot-pounds) nut setter or screw driver. For close bolt center work. Made from stock components to your specifications.

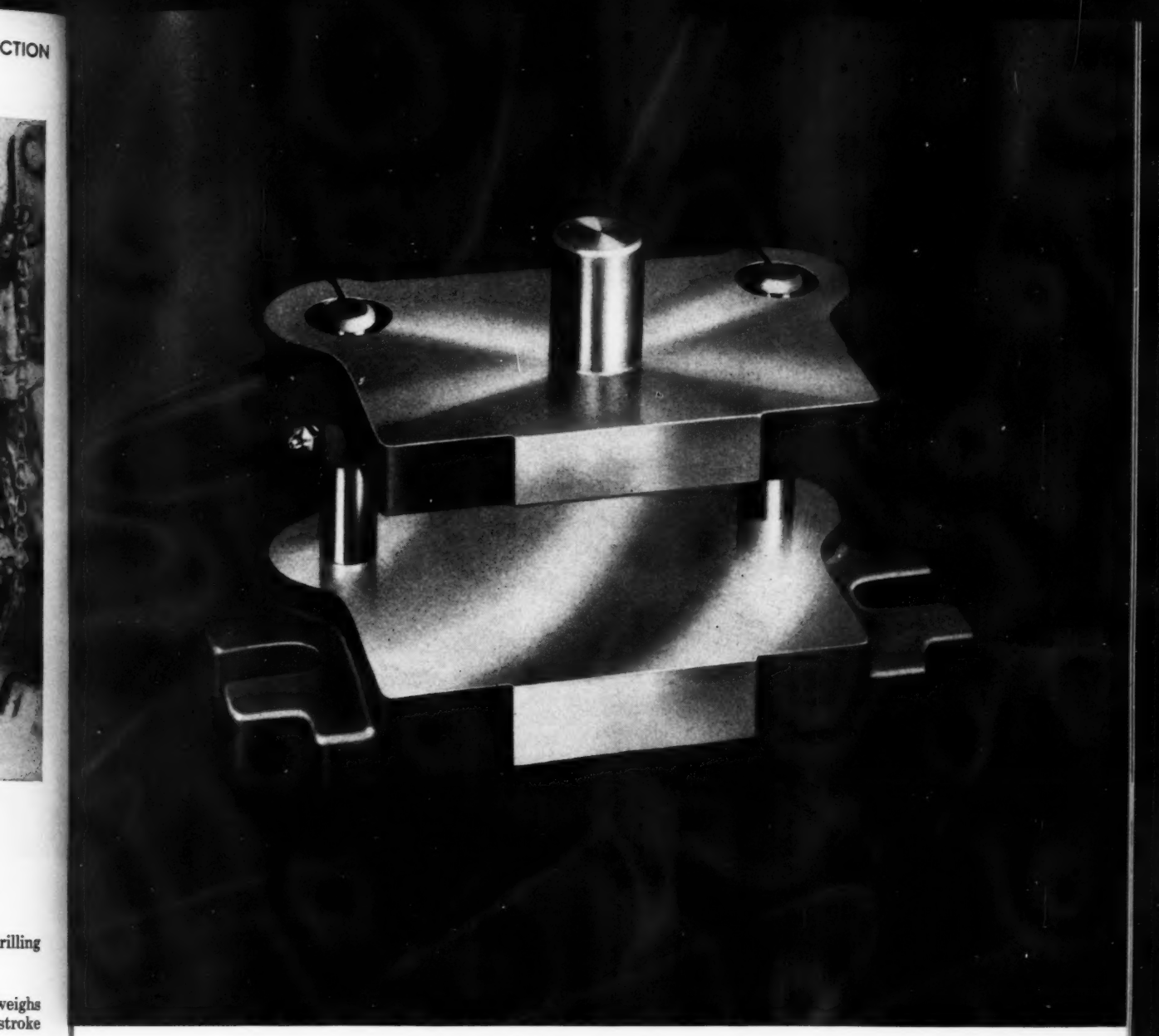


GARDNER-DENVER

KELLER TOOL division, Grand Haven, Michigan

THE QUALITY LEADER IN COMPRESSORS, PUMPS, ROCK DRILLS AND AIR TOOLS FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

CIRCLE INFORM-A-GRAM KEY NO. 44



THIS IS RIDICULOUS...

No one but a photographer ever saw a die set as shiny-bright as this one. If it's not being worked on in the tool room, usually it's buried away in a punch press, covered with oil and dirt, banging out piece after piece day after day.

And each one of those pieces is just like the others within a few thousandths of an inch. That's precision, the secret behind the success of mass production.

That's the reason for the die set's existence—to aid in maintaining precision just as long as possible. To do that, it has to be precision built.

Factory-assembled and factory-inspected, Detroit die sets meet the most important requirement of a die set, precision, in their parallelism, squareness and finish. High-quality materials plus more than ample size maintain that precision.

Over 2000 standard, stock die sets are detailed in Detroit Die Set's new catalog. Details on specials and accessories, too. Ask for it on company letterhead, or call your local representative.

OFFICES IN PRINCIPAL INDUSTRIAL CENTERS

Detroit DIE SET CORPORATION

2895 WEST GRAND BOULEVARD • DETROIT 2, MICH.

Why buy a press designed for someone else?

To these basic design advantages of the new Bliss SE-2 press . . .

- Enclosed design, all-welded construction, four-piece frame with tie rods drilled for electrical shrinking
- Recirculating oil system for gears, shafts, bearings, slide adjustment and *flywheel roller bearings*
- Bronze liners on the slideways running against lubrized cast iron gibs
- Motorized slide adjustment
- Counterbalance tanks
- JIC sizes
- Anti-friction bearings on *intermediate shaft* as well as on flywheel

. . . you can add any or all of these optional features

- Provision for automation controls and feeds
- Inbuilding
- Recirculating oil to the slide gibs
- Recirculating oil to the cushion gibs
- Automatic lubrication to counterbalances and cushion internals
- Air and electrical maintenance outlets
- Die lights
- Air control manifolds
- Special controls

A Bliss Chief Engineer tells...

How press buyers can "tailor" Bliss' new eccentric-gear design to fit their own needs!

"It's almost impossible to design a large press to please everyone. Yet that's exactly what we have tried to do with our new one point, two point and four point presses," says Chief Engineer Bill Staecker, of Bliss' Canton Plant.

"Here is how we approached the problem. Our field sales engineers worked for months with customers' operating executives and our press designers. On the one hand were the widely varying requirements of the big automated mass-production stamping plants; on the other, the needs of the job shops who use their presses for short runs. It was rare to find two sets of requirements alike.

"Flexible" design proves answer

"It was apparent that what was needed was a *flexible* basic design—a press that could have features added or subtracted to meet any user's needs without making him pay for features he didn't want. You can see how we have solved the problem by looking at the table of specifications at the left.

New drive cuts maintenance

"But...above and beyond the benefits of this basic design, these new Bliss presses have a 'unitized' drive mechanism based on a special *demountable* flywheel and outboard clutch. To get an idea of what this unitized design does for maintenance, consider these facts:

"Except for the main gears, nothing is built into the crown. The entire drive can be removed as a unit. Belts can be replaced without removing anything but the brake pins. And the entire clutch can be taken off simply by removing the brake bracket.

"You can see what this ease of disassembly and reassembly means when you compare it to maintenance steps on your present enclosed presses."

To sum up, when you buy one of these new presses, you pay for just what you need *and no more*. And you're buying the only fully-enclosed straight side press that is truly easy to maintain.

The new Bliss eccentric-gear presses are available in a full line of tonnages in both double and single geared models. For full details, write us today.

BLISS
SINCE 1857

100 years of making metals work for mankind

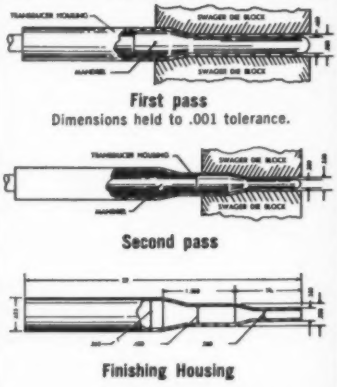
E. W. BLISS COMPANY, CANTON, OHIO
PRESSES, ROLLING MILLS, ROLLS, SPECIAL MACHINERY

U. S. Plants: **Canton, Cleveland, Salem and Toledo, Ohio; Detroit and Hastings, Michigan; San Jose, California; Midland and Pittsburgh, Pa.; Branch Offices throughout the country.**

Entire drive comes off as a unit!

ARE YOU MACHINING **when you should be SWAGING?**

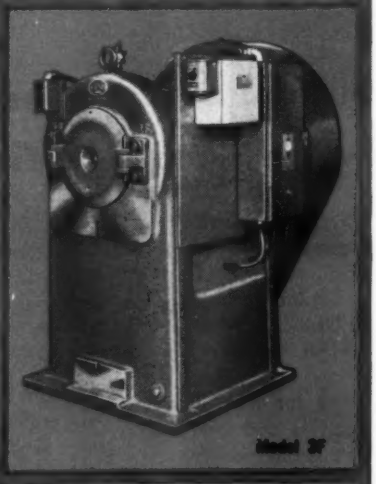
SWAGING TRANSDUCER HOUSING



First pass
Dimensions held to .001 tolerance.

Second pass

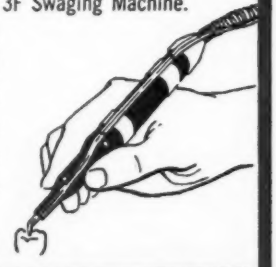
Finishing Housing



How SWAGING cuts costs 80% on Transducer Housing

The Cavitron Ultrasonic Dental Unit provides a marvelous new method for preparing cavities without noise, vibration and heat which contribute so greatly to dental pain and discomfort. Internal dimensions of the transducer housing are critical. A mating cap requires the outside diameter to be rigidly held as well. This housing was formerly machined in two parts and silver brazed together. Now, it is made in one piece from tube stock in 2 passes on a Fenn Model 3F Swaging Machine.

RESULT — Cavitron has not only reduced cost of the Transducer Housing 75% to 80% but now has a simplified one-piece housing that is stronger, easier to make and with a smooth, bright surface resulting from swaging which requires no additional finishing. Write for catalog and full information.



FENN

SWAGING
may have important advantages and savings in the manufacture of your products. Fenn engineers are at your service.

Precision Rolling Mills

Turret Heads

Wire Shaping Mills

Swaging Machines

Wire and Tube Drawing Machines

Fenn Manufacturing Company • 206 Fenn Road • Newington, Connecticut
CIRCLE INFORM-A-GRAM KEY NO. 48

Talk of the Month

NUMERICAL CONTROL POTENTIAL IN THE AIRCRAFT INDUSTRY

by K. G. Wood
Assistant to the Manager
Facilities Engineering
BOEING AIRPLANE CO.
Seattle, Washington

AFTER WITNESSING A SERIES of remarkable tests, I am convinced that Numerical Control will be of considerable value to the Aircraft Industry. I say this without qualification for I have seen an aluminum profile part that once took 23 days to produce on conventional machines, planned, programmed, and made in less than half a day (Chart A). Three and a half hours were needed to make this part with a conventional tracer machine. Using Numerical Control it was cut far more accurately in 14 min (Chart B).

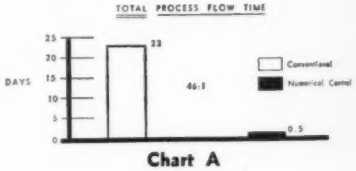


Chart A

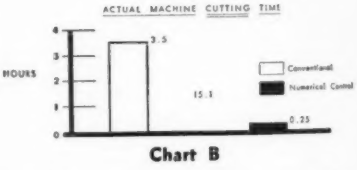


Chart B

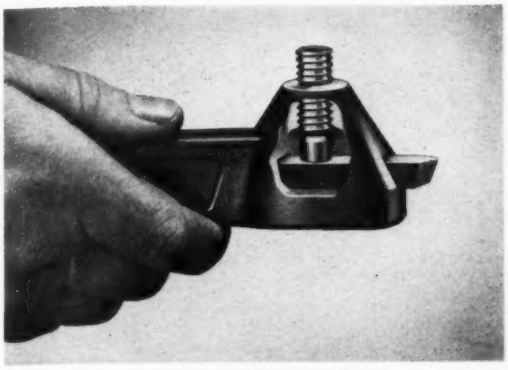
Obviously, there is no need to define Numerical Control here, but I will explain the possibilities of Numerical Control in the Aircraft Industry. We believe these possibilities are extensive.

In many respects the Aircraft Industry is not like other manufacturing businesses. While our companies have some of the largest manufacturing plants in the world, nearly all of our products are built by custom

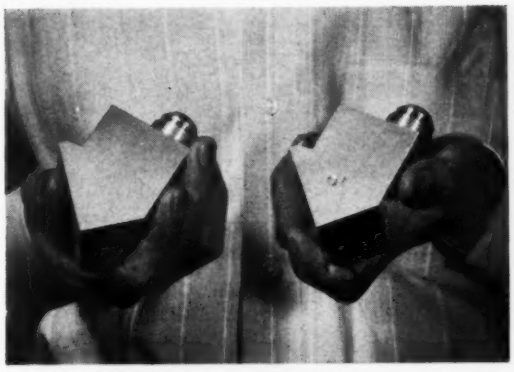
A talk given at the last Conference on Machine Tools sponsored by the American Institute of Electrical Engineers.

Practical Tooling Tips

Everyday more and more shops are using standard Vlier Tooling Accessories in place of custom-made devices for both tooling and original equipment applications. The precision construction, product uniformity and quick availability of these simple time-savers have made them tool room favorites. Why don't you start saving from their use?

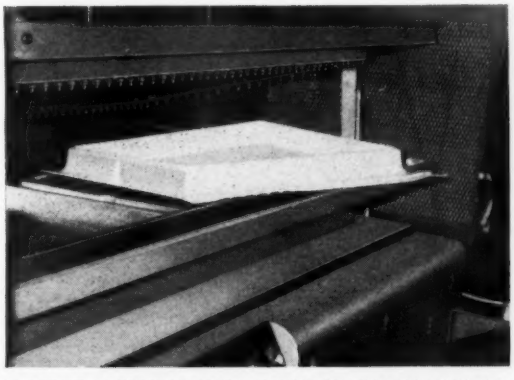


TO GET GREATER TOOL BIT RIGIDITY replace the tool holder screw with a Vlier Swivel-Pad® Clamp. The large, flat pad face provides many times more clamping area. Bits can be held tighter, reducing chatter and vibration. Small, narrow cut-off blades, multipoint tools, even stub ends can be rigidly held. Unique ball joint construction gives smooth angle adjustment in all directions.



EASY WAY TO STOP MARRING surface of part held in fixture. The part on the left was securely held in the fixture with a Vlier Swivel-Pad® Clamp. The scrapped part on the right was held with an ordinary set screw. With the Vlier Swivel-Pad® Clamp the pad stops at first contact with the part; screw torque is absorbed by a ball, preventing damage to the part. This exclusive ball joint construction also provides adjustment to off-angle surfaces.

SPRING PLUNGERS LET WRENCH DO MULTIPLE DUTY—The compression tool shown above is used to attach connectors to electrical wires. Formerly, each size wire connector required a different size tool. But now, through the use of Vlier Spring Plungers, one tool attaches all sizes of connectors—through the use of changeable jaws. The appropriate jaw for any size connector is easily inserted, accurately positioned, and held in place with a Vlier Spring Plunger.



THE RIGHT AMOUNT OF END PRESSURE AND NO MORE is what this spring plunger application calls for. More than 150 Vlier Spring Plungers are used to hold a plastic sheet in position during the forming operation of a plastic refrigerator door liner. Spring Plungers provide just the right amount of pressure to produce a perfect liner.

New catalog now ready! Send for your copy today.

Insist on Vlier Tooling Specialties... there's still no substitute for quality.

VLIER ENGINEERING INCORPORATED

8900 Santa Monica Blvd., Los Angeles 46, California

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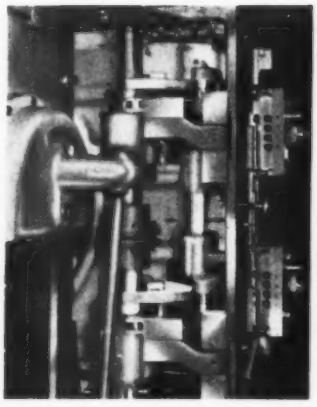
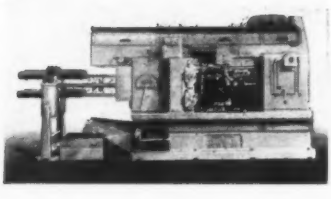


Conomatics Provide Radial Screw Adjustment of Forming Tool Slides

Models 2⅝" LA, 3½" AD, 5" KL, and 5¼" KR Conomatic Four Spindle Bar Machines are equipped with a number of quick job-change features. One of these is the all-position end attachment drive for the mounting of endworking opposed spindles in all positions, with independent feed to as many as three opposed spindles on a single setup.

Another feature that is of considerable importance in tooling up is the radial screw adjustment of all sideworking slides. Trial cuts may be taken to correct diameters with form tools without changing the clamped positions of the form tool holders.

All Conomatic quick changeover models are equipped with dial adjustment of the working stroke of all tool carrying slides. Besides the Four Spindle machines there are three quick change Six Spindle models in 9/16", 1" and 1⅝" sizes.
Write, wire, or phone for literature.



Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U.S.A.

CIRCLE INFORM-A-GRAM KEY NO. 50

techniques. Since real quantity production is never found in the aircraft business, it was natural that we considered automatic manufacturing something that could be used only in factories producing can openers, refrigerators, or automobiles. But today we are beginning to see the importance of Numerical Control to a large part of our manufacturing operations.

Our products require precise and efficient manufacturing methods. These methods, in addition, must not be so rigid that design changes, on which we thrive, cannot be incorporated into the end product in a relatively short time.

Performance specifications of aircraft are continually advancing and greater demands are made of our design engineers, and ultimately of our manufacturing shops. Faster speeds, higher altitudes, and better maneuverability require that our plants be stronger, and safer, and in addition, built within slimmer and more streamlined shells. Aerodynamic smoothness and matching fits become more exacting with each succeeding model.

This, of course, makes the job of our design engineers extremely difficult. Profound ingenuity is needed to design a reliable high strength structure within a slim enclosure. But the design engineer's problems do not end with the completion of a theoretically workable design. For the design engineer must cope with the limitations of manufacturing techniques. He must adjust his design, often compromise it before the structure can actually be manufactured with the available machines.

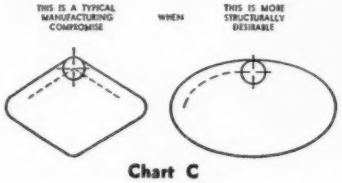


Chart C

An example of design compromise is shown on the Chart C. Numerical Control will eliminate much of the need for such compromise, for it improves manufacturing methods and techniques. With it, there is a greater freedom in producible shapes and outlines, and also the promise of a much finer control of finished dimensions.

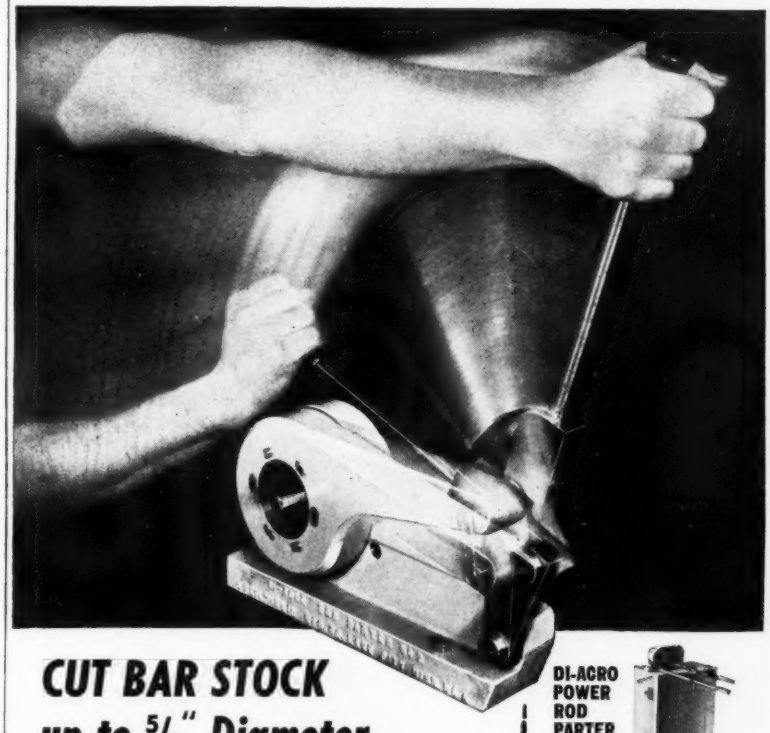
The heat generated by friction at high speeds necessitates building planes with high strength materials such as titanium and stainless steel. Such planes are now in design and when manufacturing begins the problems will be bigger than those encountered in building today's planes. The heavier weights of titanium and steel make machined tolerances more exacting, since excess material wil penalize the plane's performance more than it does with aluminum. Both test and theory show that Numerical Control can provide closer tolerances than conventional machining methods. Consequently, Numerical Control strongly appeals to us.

Other aspects of Numerical Control are also attractive. For example, we manufacture many parts but nearly always in small lot sizes. This requires frequent changes in machine setups. The flexibility of Numerical Control, the way a machine can be reset to produce a different part with ease and speed, is very valuable to us.

Of course the Aircraft Industry will enjoy the same benefits of Numerical Control as other industries: the elimination of repetitious adjustments by the operator during the production of successive identical parts. Human error, the lack of consistant good judgment, will be eliminated, and the heavy costs of training people to operate the more productive machines of the future will be reduced.

For our industry, and for many others, Numerical Control is really a new philosophy of manufacturing.

. . . *Continued on Page 53*



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*pronounced Die-ack-ro

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It will dynamically affect every aspect of production, from engineering concept and design of an individual part to assembly of the finished product.

A good example of the new and efficient way of planning and processing technical data that is now available through Numerical Control, is shown by a comparison of two methods of preparing a control tape for the profile part, mentioned above. Using desk calculators, planning and preparation of a control tape took 70 hrs. Using Numerical Control computers, the control tape was completed in 2 hrs; a time saving of 35 to 1. Such time saving coupled with avoidance of human error in calculation and copying, renders the use of computers vital in data preparation for Numerically Controlled machines.

It is well known that Numerical Control is an efficient way of controlling fabricating machinery. The fact that Numerical Control will be an efficient way of regulating and controlling quality is evident in the research and development of numerically controlled inspection machines now in progress. With the aluminum profile part, only 14 min were required for cutting, but inspection took 12 hrs. It took fifty times longer to inspect for quality than to make the part. Certainly, this is an area for improvement.

The fundamentals of Numerical Control soon should be incorporated successfully into automatic inspection devices that can rapidly verify the quality of a part and provide permanent printed records of inspection results. When that has been perfected the Aircraft Industry will realize more of the benefits of Numerical Control.

These three operations, the efficient planning and processing of data, the control of equipment and the rapid inspection of quality, constitute the new philosophy of manufacturing that could revolutionize a large part of our manufacturing operations.

There are factors that will influence the rate of acceptance of Numerical Control by the Aircraft Industry. Many of these can be defined. Some can be controlled by the Aircraft Industry and others must be controlled by the manufacturers of the equipment. For example, is Numerical Control equipment reliable? This, of course, is dominant. Is the equipment easily maintained? Is an extensive training program necessary? Is the equipment durable enough for daily factory operation? Is the equipment of high quality or is it breadboard circuitry in fancy cabinets?

In the Aircraft Industry we are well aware of the complexities involved in the design and manufacture of automatic equipment. We

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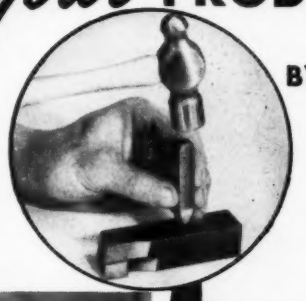
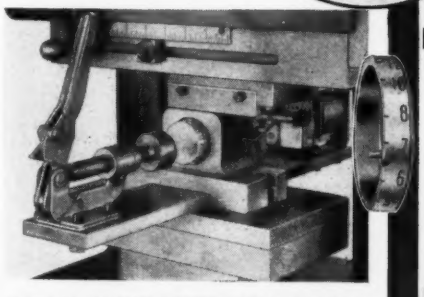
for identity, for product recognition



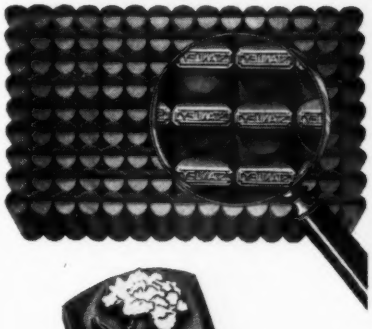
BY HAND...

handstamp trade marks, legends on short run components.



BY MACHINE...

automation in marking on production runs, manually, hydraulically or by air.



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for metal, wood or plastic products with standard or special marking dies.

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for indenting softer materials or stamping gold leaf or foil into plastic, leather, etc.

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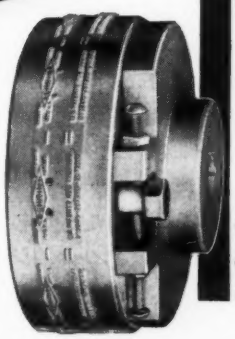
on virtually any surface with flat, concave, convex or roll printing dies.

Send for folders and descriptive literature on Parker marking tools and machinery.



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CIRCLE INFORM-A-GRAM KEY NO. 53

know early in the program there will be "bugs" and we will need the assistance of manufacturers for correcting the early difficulties so that the first and most critical applications of Numerical Control will be successful. Successful early operations will indicate the phenomenal advantages that extended use will bring.

The capital investment cost is also important to us. High pressure talk about potential will not sell Numerical Control to Aircraft Industry management if the initial cost is unreasonable, since early operating returns are only speculative. The rate of acceptance in our industry will be directly affected by the amount and kind of groundwork and preparation we do. Most of our companies already have started programs of training, indoctrinating, and familiarizing management and personnel so that when the time is right for changing manufacturing methods, Numerical Control will not be a totally foreign subject.

Similarity of systems, particularly data and memory storage forms, will also affect the rate of acceptance. The greater the similarity the more rapidly our industry proper and our sub-contractor will accept Numerical Control. Any sub-contractor, naturally, will be reluctant to invest in equipment that is not compatible with the equipment used by the prime builders he serves. Compatibility of machines also helps the Government achieve mobilization flexibility, a vital factor in realizing a successful defense program.

To summarize, our industry can see the outstanding advantages Numerical Control offers and we can safely predict a broad and fruitful application of Numerical Control throughout our plants. Our products, without exception, are continually aiming at higher performance. Numerical Control offers a sound way of building an airplane more closely to optimum design than ever before. It is more than a method of automatically controlling machines; it is a philosophy of manufacturing that affects the entire cycle of production, from the engineering drawing to the approved finished part. Data preparation and processing, automatic machine control, and automatic quality control are the basic elements that, when combined, compliment and supplement each other to form this new philosophy.

We are anxiously looking forward to and planning for the day when Numerical Control will allow us to make better airplanes, cheaper and faster than previously possible. Most of us are already laying the groundwork for the introduction of Numerically Controlled machines. Preliminary planning at Boeing has been underway for several months, and we expect to realize a large return

Cost Less in the Long Run . . .

. . . because PRATT & WHITNEY KELLER CUTTERS produce *more* accurately machined pieces per tool and run longer between grinds. The result is lower *tooling costs* than with other cutting tools which may cost less initially, but produce less. Correctly designed, precision manufactured from selected steels and inspected to meet rigidly high P&W standards, they are *quality* from start to finish! Now produced in both straight and taper shank types in a wide range of lengths and diameters. Available from stock at the P&W Branch Office near you.

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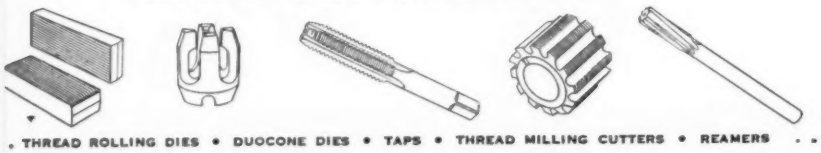

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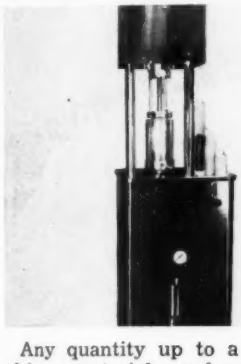
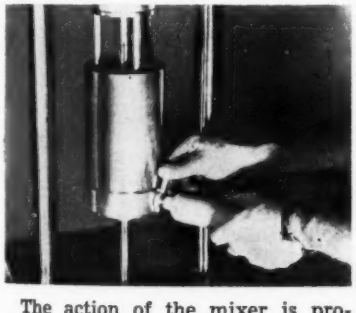
on our investment relatively early. Thanks to the pioneering efforts of many people, Numerical Control will result in a scientific regulation of work flow in many operational areas of the Aircraft Industry. I am certain that computers, servo mechanisms, and electronics in general can now be instrumental in our manufacturing just as they have been important for many years in designing and equipping the "flying machine."

AIR-FREE MIX ASSURED WITH PRESSURE MIXER

Designed for blending catalyst and additive materials in a container in a manner that assures air-free mix is the Pyles Semco Pressure Mixer. It is available in five models from a one-quart laboratory mixer to a five-quarts production mixer.

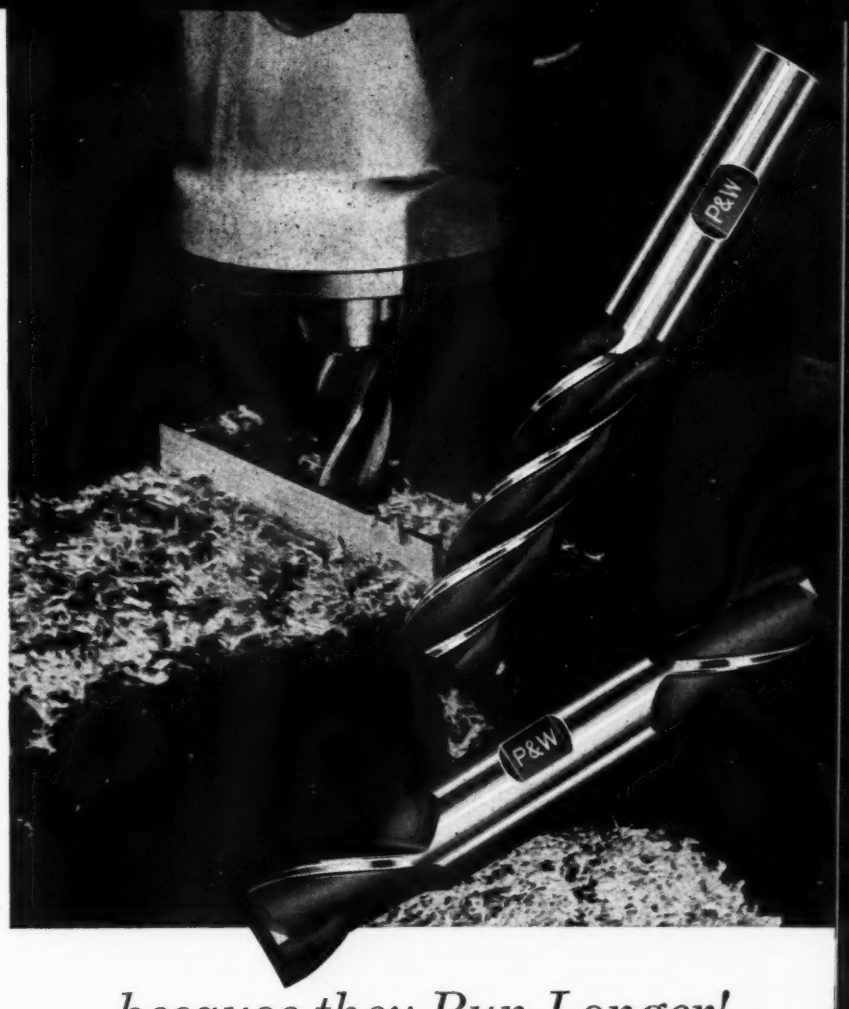


Any quantity up to a full quart of base material can be mixed in a few minutes. The mix is then delivered, under pressure, into a polyethylene cartridge for use with the Pyles Semco Sealant Gun.



The action of the mixer is provided by two double acting air cylinders. The lower cylinder holds the container under pressure while the upper one forces a dasher through the material. A counter registers the dasher cycles providing positive uniformity of batches.

Further information on the air-free pressure mixer is supplied by Pyles Industries, Inc., 8926 - 2nd Ave., Detroit 2, or — **Circle No. D1.**



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Rotor Air Tools: Assembly Tools • Drills • Small Wheel Grinders
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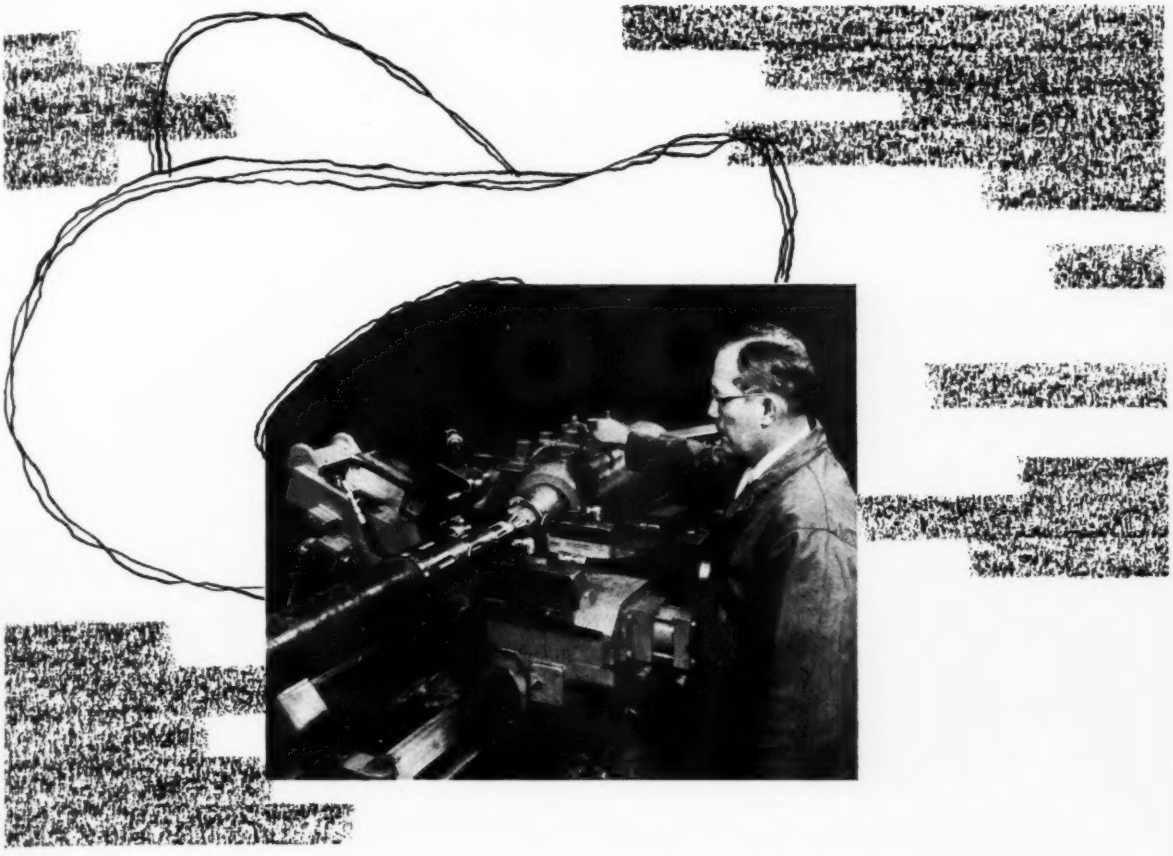
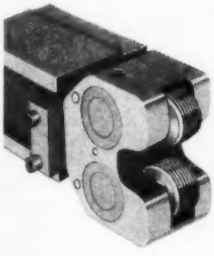


Roll your own *in no time* with a Monarch Mona-Matic!



ON THIS JOB, thread rollers mounted on the hydraulically-operated rear slide perform a very precise thread rolling job *during traverse return* of the front carriage. If that's not strictly "no time," it's certainly "no-cost time"—and who could possibly want more than that?

The part is a fabricated trailer axle, about 80″ long, identical spindle ends of which are turned and threaded. There are three turned sections on each end with the end diameter threaded at the tag end of the cycle.

Because the axle is fabricated by butt welding the forged, rough turned spindle ends to a piece of seamless steel tubing, an interesting front carriage cycle is employed. During one of the three feed movements, the welding bead is removed by a tool on a hydraulically operated auxiliary slide mounted on the left hand end of the carriage.

And that's only part of the Mona-Matic savings story! Customer used to turn on one machine, thread on another with a die head. Now he does the *whole job—on one machine—faster than just the turning used to take.*

Remember that thread rolling (up to 1½″ diameter) is an extra for some users—only one of many that can be yours when you turn the Mona-Matic way. Let us figure a job for you...**The Monarch Machine Tool Company, Sidney, Ohio.**

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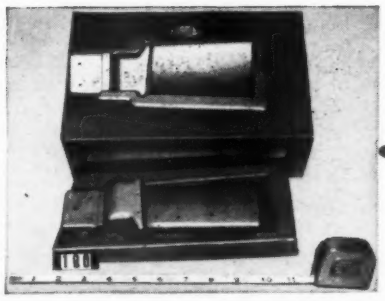
TURNING MACHINES
FOR A GOOD TURN FASTER . . . TURN TO MONARCH

CIRCLE INFORM-A-GRAM KEY NO. 57

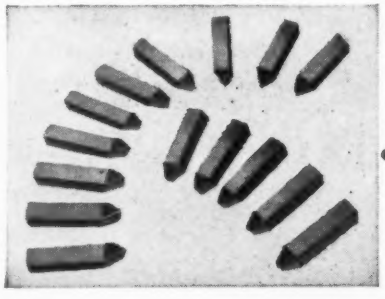
FORGING DIE

Material: Heppenstall 'A'
Conventional Machining
Time: 40 hours
Elox Setup & Machining
Time: 8 hours
Saved: 32 hours
Machine tool: Elox Standard M-500
Electrode: Cast Elo-met #3
Customers report 75% time saving in re-working dies after washout . . . no annealing is necessary.



TUNGSTEN CARBIDE SINGLE POINT TOOLS

E D M produces 14 identically machined tools per hour. Times include roughing and finishing, machining both faces, nose radius and top. Radius held to ± .001". Tools were produced by 1 man operating 2 Elox Tool & Cutter Grinders, using a brass wheel. Users report Elox ground tools give greatly increased life when compared to abrasive ground tools.



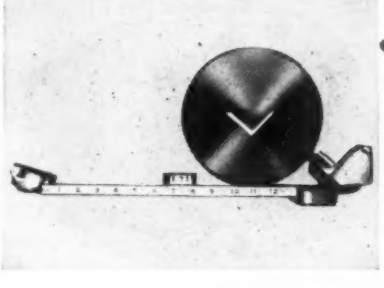
EMBOSSING DIE

Material: Air Hardened Tool Steel
Die consists of 1,250 squares machined .100" x .030" deep in the bottom section of the die. Sharp corners on each square had to be maintained.

Conventional Machining
Time: 227 hours
Elox Setup & Machining
Time: 10 hours
Saved: 217 hours
Machine Tool: Elox Standard M-500
Electrode: Free machining brass

EXTRUSION DIE

Material: Air Hardened Tool Steel
Conventional
Machining Time: 4 hours
Elox Setup &
Machining Time: 1 hr. 38 min.
Saved: 2 Hrs. 22 min.
Machine Tool: Elox Standard M-500
Electrode: Free machining brass
Machining is done after final heat treating . . . eliminating the possibility of distortion.



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. . . 4 jobs that prove Elox puts you ahead of competition

These jobs were done for Elox customers in our "Prove It" Division. There's more to them than just "man hours" saved. The Elox sales engineer in your area would like to give you all the details about these and other applications of Electrical Discharge Machining. Why not write . . .

elox corporation of michigan *T. M. Reg.

1834 N. Stephenson Highway
Royal Oak 3, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 58

Skinner power chucks will cut your over-all machining costs

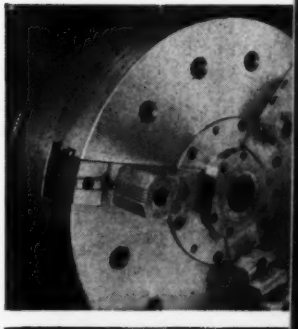
Right from the start, you begin to add up savings in cost-per-piece when you equip your production machines with Skinner Power Chucks. Instantaneous gripping and releasing by these air-powered Skinners cut substantially the over-all time required for machining.

If you're using manually operated chucks on your production machines, you're running your costs up with every cut, and wasting operators' time with hand wrenching. Skinner Power Chucks enable you to get the full time-saving advantages of modern engine and turret lathes by converting them to high production machines.

We'd like to show you how Skinner Power Chucks will reduce machining costs on production jobs in your plant. Write for Catalog 68P2, with complete specifications, applications and installation instructions.

Simple, Dependable Safe Operation

The tight gripping jaws are closed or opened instantly by an actuating wedge, operated by a double-acting air cylinder. This simple mechanism is positive and trouble-free—there are only four moving parts in the chuck head. If air pressure suddenly fails, the jaws do not release the work piece, but continue to hold it tight until air pressure is restored.



Operator's Hands Are Free To Guide Work Pieces

Skinner Power Chucks are operated either by foot or hand valves. The operator can position work pieces and close jaws instantly, sure that the piece is correctly and firmly held with equal pressure. Cuts operator fatigue, too—air pressure does the hard work.

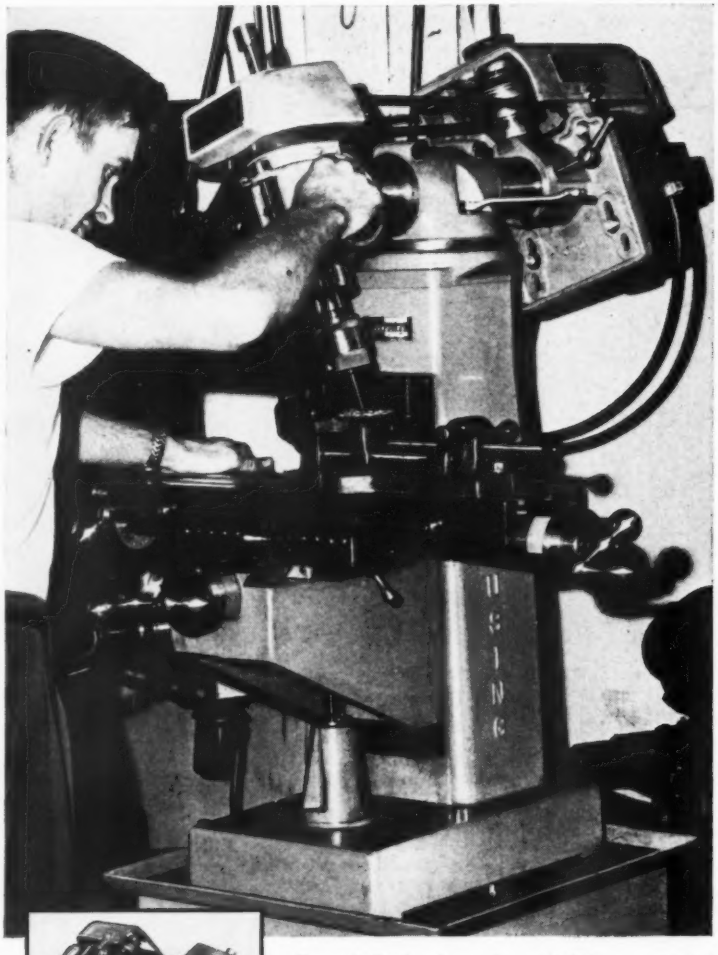
SKINNER CHUCKS

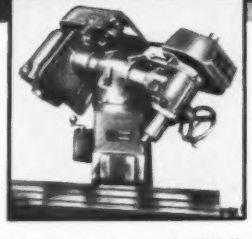
THE SKINNER CHUCK COMPANY

ESTABLISHED 1887

NEW BRITAIN, CONNECTICUT

"EXCEPTIONAL SENSITIVITY" with the CLAUSING VERTICAL MILL





The spindle head can be swiveled in a vertical plane and set at any angle, and turret rotated in a horizontal plane making it possible to mill, drill, bore, ream and shape at all angles with one set-up. Quill has micrometer depth control stop and two feeds, lever and hand wheel.

The heart of the CLAUSING MILL is its rigid, high precision spindle head. It has 7 ball bearings . . . spindle is chrome nickel steel, hardened and ground . . . quill, ground and hard chrome plated, has full-length honed bearing seat . . . overarm is an electric furnace casting, with ¾" thick walls, precision ground.

D & S Tool and Manufacturing Co., widely known for precision tool and die work, reports: "Our men prefer CLAUSING MILLS for die working. They have a sensitivity you don't get in larger machines that really pays off in accuracy and efficiency on every operation using small cutters, and the time they save in job set-ups is substantial."

MOST ACCURATE MACHINE OF ITS TYPE and CAPACITY

Each CLAUSING Mill must pass these rigid tolerance tests:

1. Top of table perpendicular to column ways, both directions, within .0005" in 8" travel.
2. Table top, front to back, square with column ways 0 to .001".
3. Table, parallel to turret within .001".
4. Spindle square with table, front to rear, within .001" T.I.R. in 5" circle.
5. Spindle taper (internal) run out within .0002" at spindle nose.
6. Table T-slots parallel to table dovetail ways within .0005" in 8" longitudinal travel.

CONDENSED SPECIFICATIONS

Size of Table	6" x 24"
Longitudinal Table Travel	15"
Transverse Table Travel	5"
Vertical Table Travel	11⅝"
Maximum Distance Spindle to Column	8¾"
Quill Travel	3"

Spindle Speeds: Six, 180 to 3250 RPM. No. 7 Brown and Sharpe or No. 2 Morse Taper Spindle Optional. Operates from ½ or ¾ H.P., 1725 RPM Motor.

MILLS, DRILLS, BORES, REAMS AND SHAPES AT ALL ANGLES WITH ONE WORK SET-UP!

Write for **FREE LITERATURE**

Atlas CLAUSING PRECISION MACHINE TOOLS — DIVISION ATLAS PRESS COMPANY

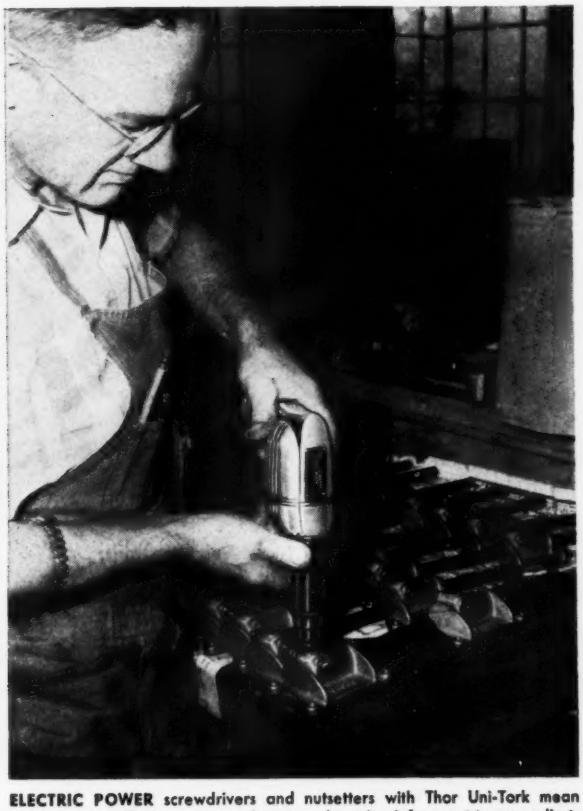
CLAUSING DIVISION

Atlas Press Company
Quality Machine Tools Since 1911
2-115 N. Pitcher St. • KALAMAZOO, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 60

Now! Thor power tools that think for themselves!

AIR POWER tools with Thor Uni-Tork have external torque adjustments from 10 to 100 inch-pounds. Thor No. 2 screwdrivers and nutsetters (illustrated) are equipped with Silentair mufflers which reduce exhaust noise by 75%. Uni-Tork tools remove operator judgement from fastener work.



ELECTRIC POWER screwdrivers and nutsetters with Thor Uni-Tork mean longer service life, less wear and tear on the unit—infrequent torque adjustments, and quiet operation. Thor electric Uni-Tork tools can be purchased from industrial distributors. Ask for a demonstration.

THOR UNI-TORK

Now available in air and electric screwdrivers and nutsetters

When Thor—pioneer manufacturer of power tools—developed air screwdrivers and nutsetters with sensational Uni-Tork, work with fasteners became as simple as turning on a light switch. Now Thor offers the same precision, effortless control of threaded fasteners in the popular "Silver Line" electric screwdrivers and nutsetters.

Thor Uni-Tork tools mean increased production on the assembly line. When the desired preset torque is reached, Uni-Tork tools snap out of adjustment—no slipping or buzzing of clutch jaws. You get ease of operation and automatic torque control. Just set and forget. Use Thor Uni-Tork, the tools that think for themselves. Thor Power Tool Co., Prudential Plaza, Chicago 1, Illinois.

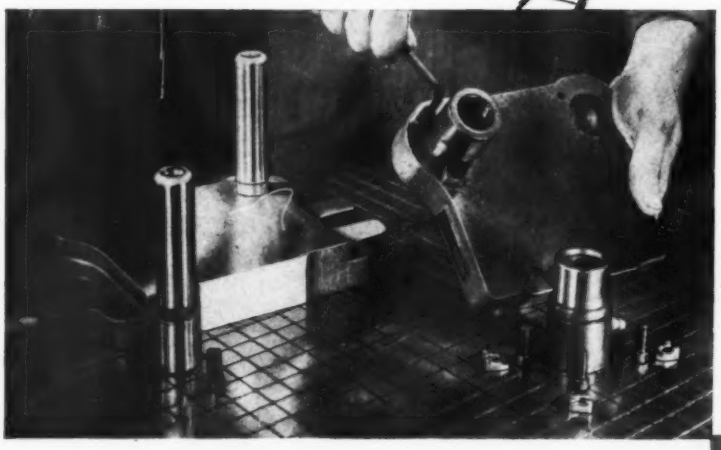
Thor PORTABLE POWER TOOLS

THOR POWER TOOL COMPANY, CHICAGO

Branches in all principal cities

CIRCLE INFORM-A-GRAM KEY NO. 61

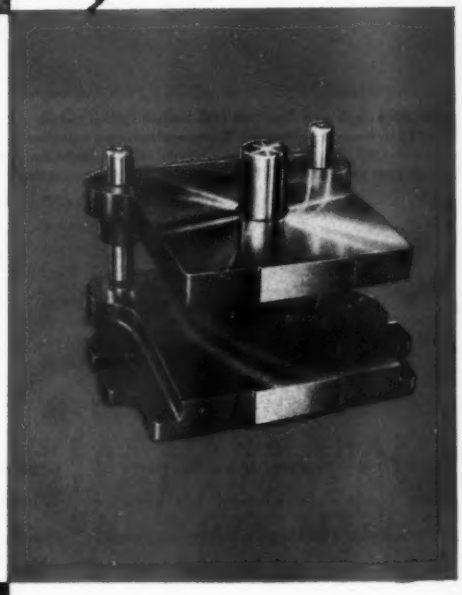
NEW quick change demountable bushings



ON NEW DANLY DIE SETS

Danly's demountable bushings, a new optional feature, are easily and quickly removed or installed . . . and an ideal companion for Danly's removable guide posts. Check these advantages: first, die maintenance work or grinding is hours faster when posts and bushings can be removed; second, several sets of interchangeable guide posts and bushings can be stocked for any die set to make die set inventory more flexible; third, because no pressing of posts or bushings is involved in assembly, the highest degree of precision is assured. A leading aircraft manufacturer reports that Danly Die Sets equipped with demountable bushings and removable guide posts permitted interchange of guide posts while holding closure accuracy within .0005".

These new demountable bushings provide exceptional resistance to wear, too, especially when used in combination with Danly MICROME chrome plated precision guide posts. No matter what your specific requirements are, you'll find that Danly Die Sets work best for you.



Complete New
"Leadership Line" Catalog

More than 200 pages provide you with complete design information, easier selection of die sets and supplies. Write for your copy today!

DANLY

DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue
Chicago 50, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 62

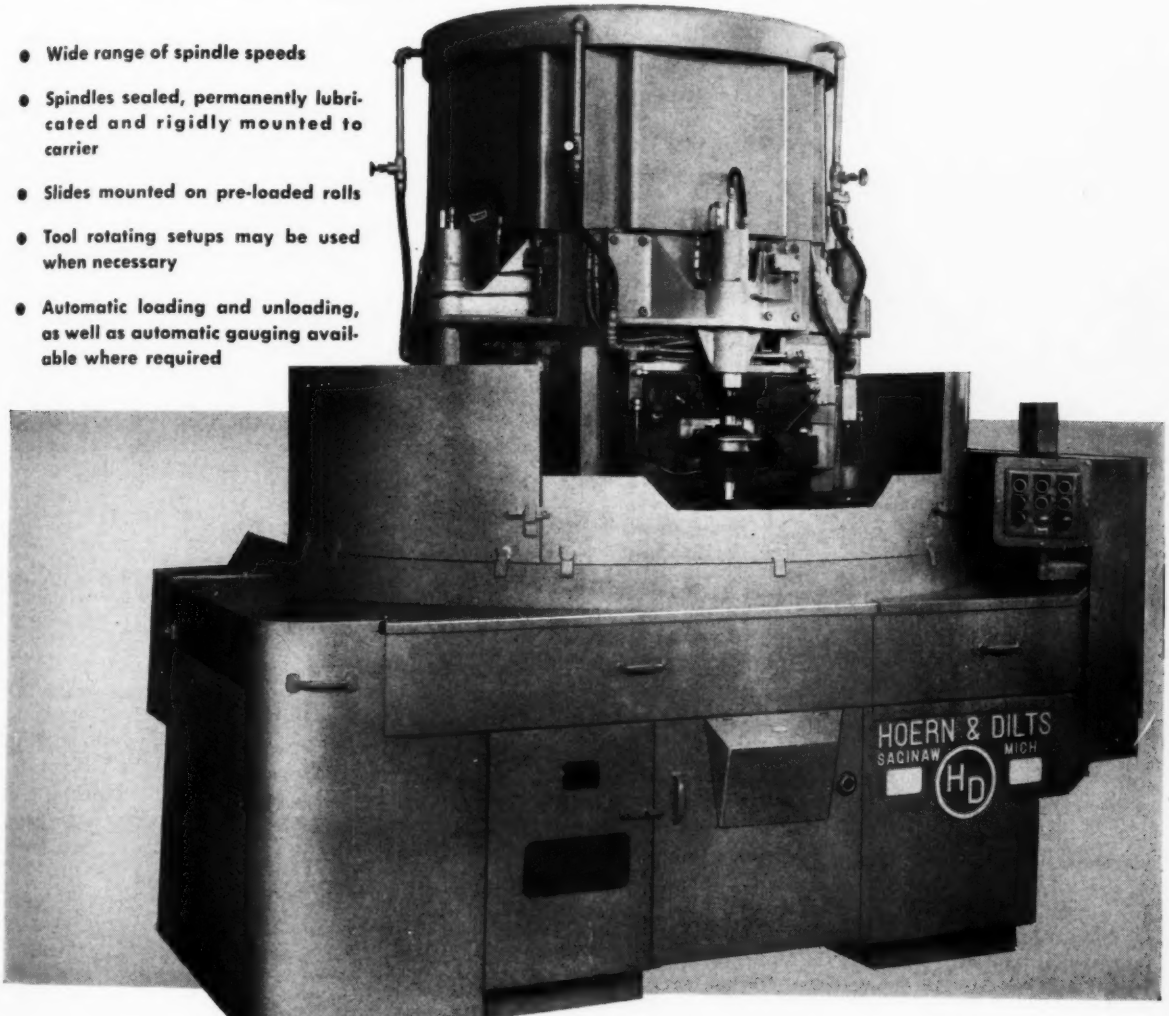
for your precision boring . . . .

5 times as many pieces every hour

Hoern & Dilts continuous boring machines have *five* sets of contour turning and boring slides, each serving one or two spindles and continuously moving around a central column. Slides and spindles travel together. Operator merely loads and unloads.

Pieces are completely turned, bored and faced in one circuit around the machine. One set of stationary cams actuating all slides provides absolute duplication of dimensions between stations.

- **Wide range of spindle speeds**
- **Spindles sealed, permanently lubricated and rigidly mounted to carrier**
- **Slides mounted on pre-loaded rolls**
- **Tool rotating setups may be used when necessary**
- **Automatic loading and unloading, as well as automatic gauging available where required**



Hoern & Dilts engineers will welcome the opportunity to cooperate with you on any high production finishing operation.

HOERN & DILTS DIVISION

The New Britain Machine Company • Saginaw, Michigan

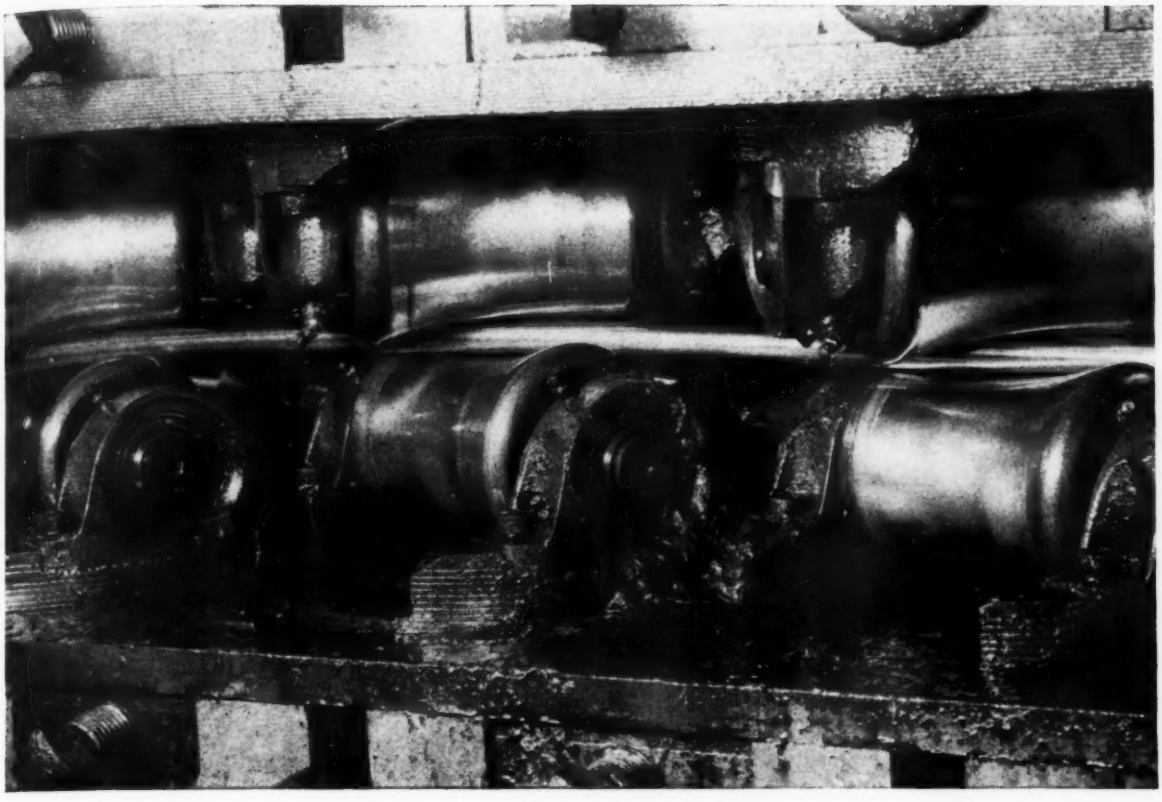
OTHER NEW BRITAIN MACHINE TOOL DIVISIONS

New Britain-Gridley Machine Division
New Britain, Connecticut
Automatic Bar and Chucking Machines
Precision Boring Machines and New Britain +GF+ Copy Turning Lathes

Lucas Machine Division
Cleveland, Ohio
Precision Horizontal Boring, Drilling and Milling Machines

CIRCLE INFORM-A-GRAM KEY NO. 63

CIRCLE INFORM-A-GRAM KEY NO. 64



Uses tool steel that outwears others 3 to 1 for its straightener rolls

TO help its customers get the longest possible life out of the rolls used in its small tube straighteners, Mackintosh-Hemphill Division of E. W. Bliss Co. makes them from Graph-Mo® steel.

Graph-Mo contains millions of tiny particles of diamond-hard carbides. As a result, users report it outwears other tool steels on an average of three to one!

Graph-Mo steel also contains free graphite which gives it outstanding anti-friction properties, prevents pick up and scoring. This is a big advantage to users of small Mack-Hemp straighteners because it results in a better surface on the products being processed. What's more it eliminates chrome plating the rolls, which is usually necessary when the straighteners are used for non-ferrous metals such as brass.

Graph-Mo steel gives Mackintosh-Hemphill two other important manufacturing advantages. It saves machining time because it's 30% easier to machine than ordinary tool steels. And it simplifies heat treating because of its uniform response to heat treatment.

Graph-Mo is one of four graphitic tool steels developed by the Timken Company. If you want more information about their use in dies, punches, gages and machine parts, write for the new Timken Graphitic Steel Data Book. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

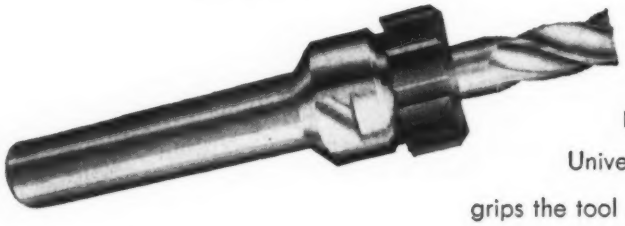
YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

CIRCLE INFORM-A-GRAM KEY NO. 65

FOR A REAL GRIP

USE UNIVERSAL COLLET CHUCKS



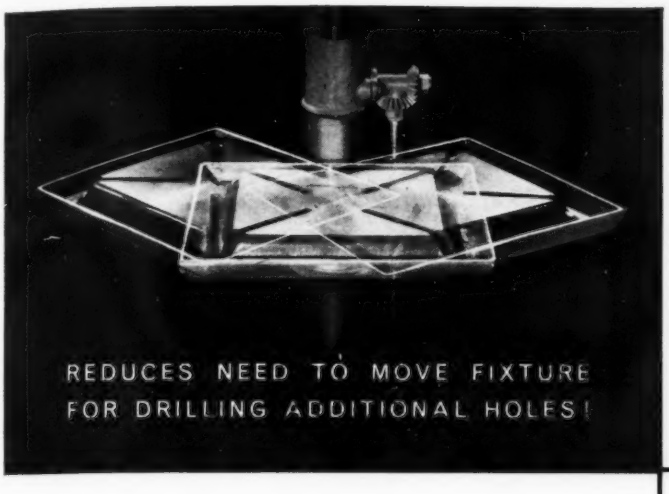
A sure, solid grip on tools is provided by the wrap-around action of Universal chucks because the slotted collet grips the tool on a continuous surface the full length of the collet. Tools can't slip and tool shanks don't get scored. Even tool stubs and broken drills can be used successfully. Sizes range from 1/16" to 1 1/2", with shanks to fit any machine. Simplified design results in low chuck cost to you. Write today for new "complete line" catalog.

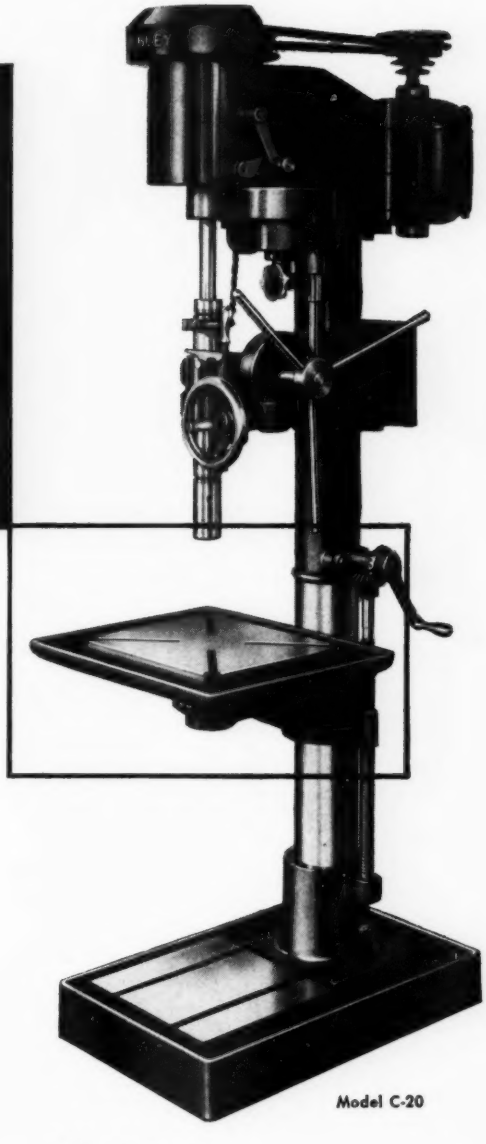
197

UNIVERSAL ENGINEERING CO. FRANKENMUTH 8, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 66

Sibley Table Swing Saves Set-up Time!





Model C-20

Lick the largest cost item in the toolroom, die shop—or small lot production! Rapid positioning by rotating table arm overcomes need to change set-up.

- **Geared power feeds. Dial selection.**
- **Back gears for extra power.**
- **Drills 1¼" in steel plate.**
- **Accurate. Rugged. Convenient controls.**
- **Sensitive for "feel" of job.**
- **20" swing. 2 h.p. motor.**

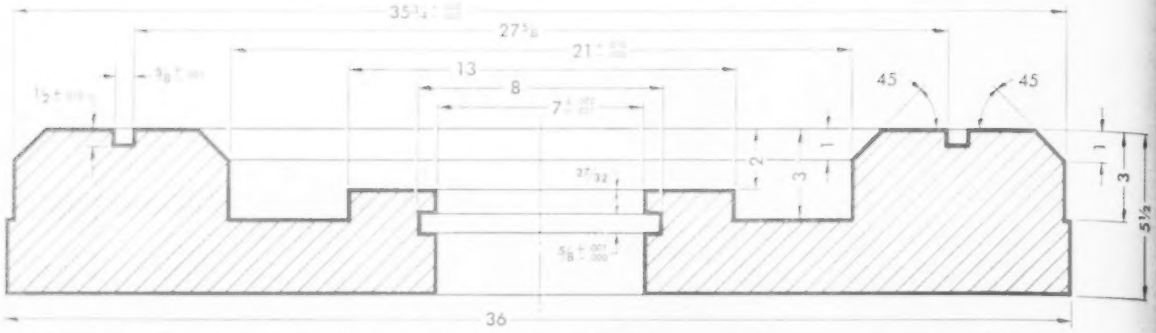
Send for *Free Catalog!*

SIBLEY
MACHINE & FOUNDRY CORP.
SOUTH BEND, INDIANA

SIBLEY MACHINE & FOUNDRY CORP.
Dept. TP-2, South Bend 23, Indiana
Send Catalog No. 67

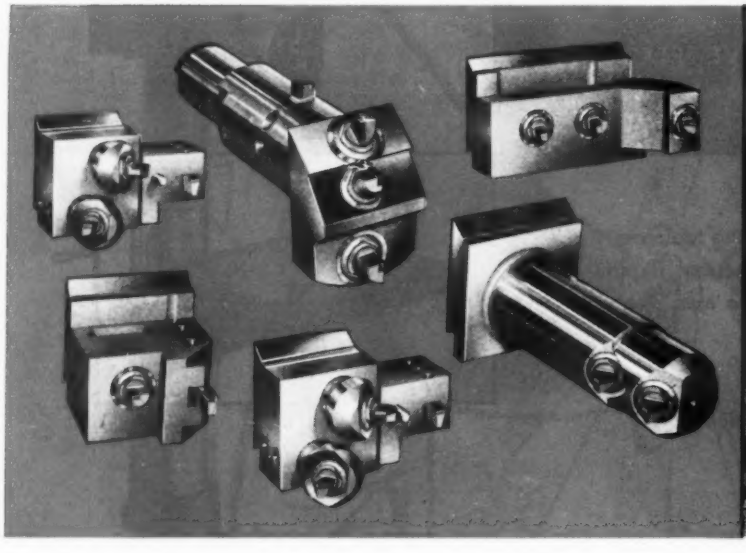
Name_____ Title_____
Company_____
Address_____
City_____ State_____

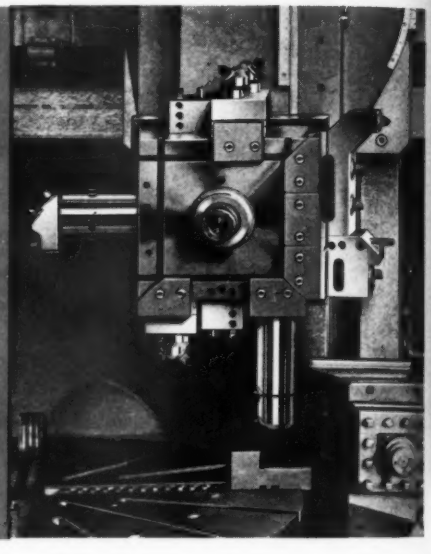
CIRCLE INFORM-A-GRAM KEY NO. 67



Certainly you can use Microbore Tooling on a Vertical Boring Mill

HERE'S HOW KING DID IT!





24 OPERATIONS BY CLUSTERING MICROBORE UNITS IN 6 BARS

• This tooling for a difficult job was designed and made by the Microbore Division and was used with great success by the King Machine Tool Division of American Steel Foundries. Notice that boring, facing, chamfering, turning and grooving operations were required and precise limits were held.

• The simple setup and quick adjustment of each individual Microbore unit resulted in a minimum of down time. This is typical of reports from shops where the Microbore System is used. Microbore is a basic tool which can be applied singly or in clusters for all types of precision boring, turning and facing operations.

• Proposal engineering from your prints and machine data is a unique feature of the DeVlieg Microbore System. Discuss your tooling problems with our specialists or let us send you our informative catalog.

DeVlieg Microbore System

DE VLIEG MICROBORE • DIVISION OF DE VLIEG MACHINE COMPANY

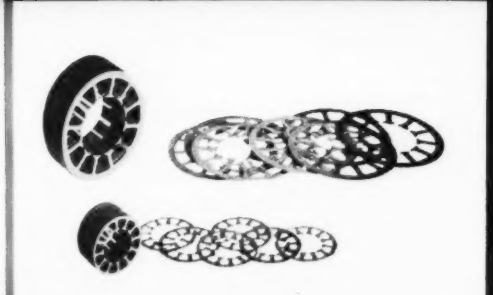
2720 West Fourteen Mile Rd., Royal Oak, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 68

Araldite®
First in Epoxies

Precision...Large Scale!
Araldite Epoxy Resins adapt themselves to large scale precision design as illustrated in this 14 foot aluminum reflector. The skin, made with Araldite and glass cloth, is then bonded with Araldite Epoxy to aluminum and honeycomb to complete the structure.
Formulator: Emerson & Cuming, Inc.
Customer: I.T.E. Circuit Breaker Co.

Precision...In Miniature!
High bond strength and excellent electrical properties of Araldite Epoxy Resins make possible the design and production of this chatter-less stator.
Formulator: Rubber & Asbestos Corp.
Customer: Kollsman Instrument Company.



Whether your use of Araldite Epoxy Resins would be for coating, tooling, electrical, adhesive or laminating applications, formulations based on Araldite Epoxy Resins can meet your requirements exactly. The excellent adhesive, mechanical and chemical properties of Araldite Epoxy Resins, plus their versatility, make them "a natural" to promote design improvements and save time and money on the production line. Here are two of the many instances where Araldite Epoxy formulations provided the right answer to large and small scale design problems.

The Technical Services of Ciba's Plastics Division are the finest in their field. For full information on how Ciba Araldite Epoxies lead to product development and production improvements, write...

Ciba Araldite Epoxy Resins come with the assurance that they have met not only our rigid PRODUCTION quality control standards but the specific APPLICATIONAL requirements of the user as well.

Ciba produces basic resins only, to be formulated for intermediate and end uses.

CIBA

CIBA COMPANY INC., Plastics Division TP-2
Dept. 2, Kimberton, Pennsylvania

Please send me full information on CIBA Epoxy Resins for

- ☐ General
- ☐ Tooling
- ☐ Structural Laminates
- ☐ Surface Coatings
- ☐ Electrical
- ☐ Hi-Strength Adhesives
- ☐ Plastic Body Solders

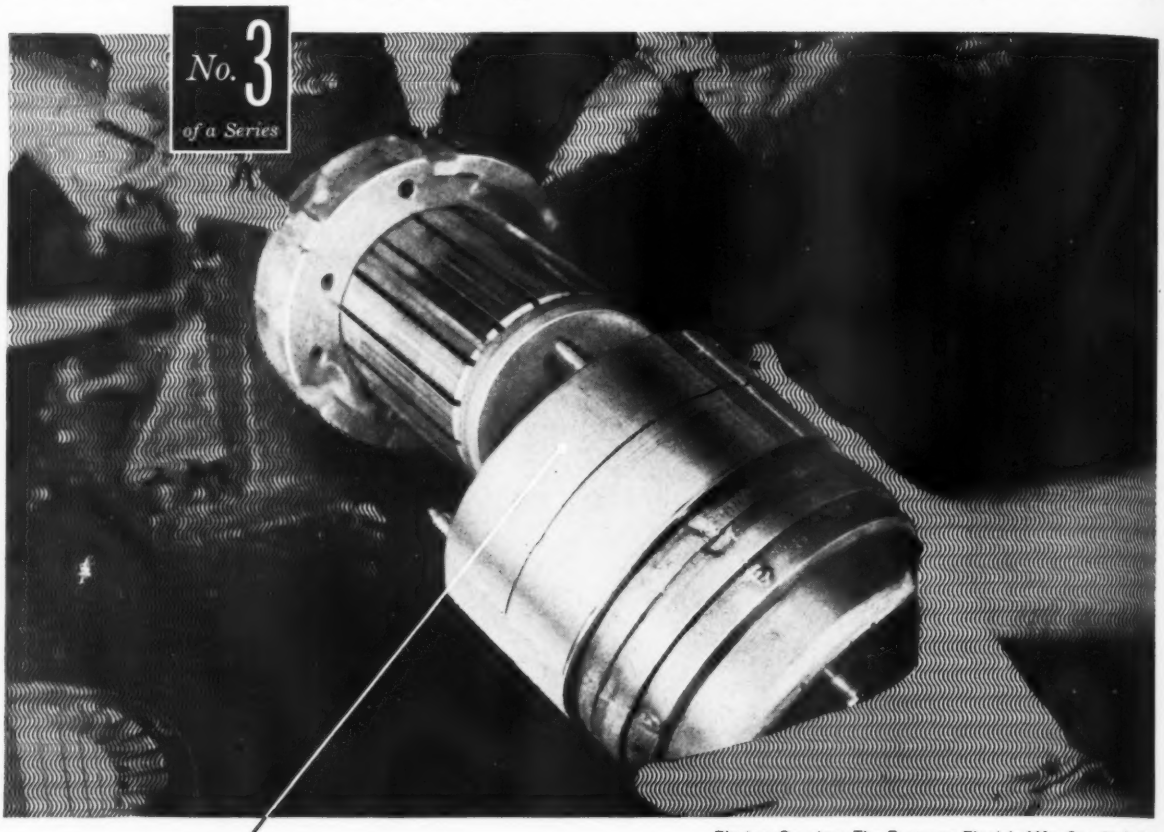
NAME_____

COMPANY_____ TITLE_____

ADDRESS_____

CITY_____ STATE_____

Erickson Precision Expanding Mandrels Solve Assembly Problems



Photos: Courtesy The Emerson Electric Mfg. Co., St. Louis

e.g. electric motor stators

Emerson Electric, big-name electrical manufacturer, assembles stator laminations the modern way—with Erickson Mandrels. Gone are the old-fashioned arbor assembly methods that require a large tolerance between laminations and arbor . . . that lead to eccentricity of stator bore and to additional finishing operations on the OD.

Emerson Electric works "from the inside out" with Erickson Precision Expanding Mandrels. Laminations are placed on a fixture and the fixture slipped over the expanding mandrel. Laminations are then welded together with two passes through a three-torch head.

Result? Stators are concentric within Erickson's guaranteed accuracy of five "tenths." And Emerson Electric gets a better motor with uniform air gap . . . that produces uniform torque and rated horsepower . . . that creates minimum electrical interference . . . and that lasts longer.

If this cost-cutting case history triggers your imagination, contact the nearest Erickson representative. He'll be pleased to demonstrate how Erickson Precision Expanding Mandrels can cut your assembly costs.

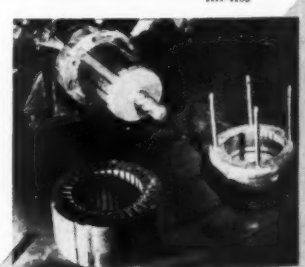
AA-4133

Collet Chucks
Floating Holders
Tap Chucks
Indexers

ERICKSON TOOL COMPANY

2301-2 Hamilton Avenue • Cleveland 14, Ohio

Tap Holders
Air-Operated Chucks
Expanding Collets
Special Holding Fixtures



ID of stator assembly (lower left) requires no finishing operation after welding.

Bothered by a tough holding problem? Then let us show you how Erickson mandrels speed production, lower grinding or inspection costs. Write for Catalog K.

CIRCLE INFORM-A-GRAM KEY NO. 70

editorial:

Our Thanks To You . . . And You . . . And You

As THIS IS WRITTEN, in the forepart of January and amidst a rash of good New Year's resolutions, it comes to us that we have been a bit remiss in expressing our gratitude to the thousands of you, our readers, who have been of great help to us in our editorial planning.

We mean, of course, those of you who have "bothered" to answer our question, "Which article in this issue was of most interest to you?" This question appears at the bottom of each of our reader service Inform-A-Gram cards. We said "bothered" advisedly because we know you are busy people and that it is a bit of a chore for you to take time out to write, as so many of you do, the full title of an article, author's name, and page number.

We would, therefore, like you to know that a lot of attention is devoted to your efforts. As the cards, pertaining to a given issue, come back to us they are serviced first as to your encircled numbers calling for information on any editorial or advertised items.

After your queries are relayed to the proper sources, the cards come to us here in the editorial department for a very thorough going over.

They are read by all of us who have to do with TOOLING & PRODUCTION'S editorial content and then tabulated, both as to article subject and your job title. Thus by statistical projection we know how many of you are most interested in what. And we like to think that by these procedures we come to know you and your interests quite intimately and can do a better job of tailoring our editorial subjects to your expressed preferences.

Thanks to the information you give us we have a lot of editorial yardsticks to work with. We know, for instance, what percentage of you found December's "The Dynamics of Confidence" by Chrysler president Colbert of greatest interest, as well as the number who were most appreciative of Fred Kahl's "Servo and Feedback Principles Explained." A most impressive number of you "voted" for Julius Hullman's developments in tubular stampings.

Even more exhaustive is our own research department's querying of several hundred readers per month. Again, many thanks are due to those of you who check-mark and return these editorial evaluation cards. They are studied and punched for analysis and classification of your collective opinions.

Thus you are doing a bigger job than you may realize in keeping us on target in procurement and presentation of "job related" editorial subjects.

In our further and continuing endeavor to improve the styling, make-up, and content of TOOLING & PRODUCTION those of you who have been approached have very graciously cooperated with the field interviewers of an editorial research organization which we have retained for the express purpose of learning in still more detail about your reading likes and dislikes.

Quite a few of you, randomly selected, from New York to Los Angeles have met these interviewers and have given generously of your time. With them you went into a huddle over our September 1955 issue. You who participated know how searching the interviews were. You were invited to express your opinions on everything from use of color on the editorial pages to the degree of technicality you desire in an article. Your opinions were recorded, accurately and in full, and transmitted to the editors.

This was just a beginning. Still others of you will be invited to give us the facts of life about later issues. The interviewers don't pull any punches and they make it very easy for you to let your hair down and tell all.

We know that many of you who expressed unanimity regarding certain aspects of September's TOOLING & PRODUCTION will have noted that our January 1957 issue incorporated changes in line with your thinking. We pledge you that there will be further changes and improvements toward easier reading, more informative and diversified articles, more attractive lay-out and art work, and more convenient positioning of some of the traditional pages and features.

The sole objective of this entire editorial research program is that by adhering to your wants and preferences TOOLING & PRODUCTION may be of continually increasing value to you in your work — to the extent that you will look upon TOOLING & PRODUCTION as your favorite magazine.

For your past help we sincerely thank you, and for your future help we will be equally grateful.

E. Willard Pennington

editor

"More than TWENTY MILLION HITS since we changed to Lamina Guide Pins and Bushings!"

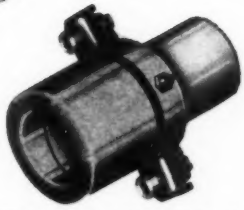
"Since changing to Lamina Guide Pins and Bronze-plated Bushings on our dies, they have run more than 20,000,000 hits . . . and they're still going! Formerly, the best we could get was 4,000,000 to 5,000,000 hits on any make." *This is a typical quotation from an actual user letter.*

Lamina bronze-plated wring-fit bushings are pre-finished on the I.D. Seated on a shoulder square with the die shoe surface and secured by special retainers, they assure distortion-free, full bearing surface that results in better die alignment, less maintenance and longer die life.

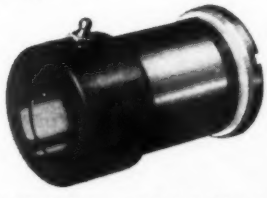
Lamina Guide Pins are special tool steel, heat treated, spray quenched, hardened, ground and burnished. The uniform, hard surface resists wear, while the tough core won't bend in installation or use. These dimensionally accurate pins do not "mushroom" or get out of round, and require no "running in."

There is a size and type Lamina Guide Pin and Bushing for every need. Our new catalog shows illustrations, applications, dimensions and prices of more than 800 items. Ask your die set supplier, or write us for your free copy now.

SHOULDER TYPE PIN. 1" to 4½" diameter. Straight and Removable types also available.



LONG SHOULDER Bronze Plated Bushing contains pin during entire stroke. ¾" to 3" I.D.



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MACHINING HIGH TEMPERATURE ALLOYS WITH CARBIDES

by William E. Montgomery
Chief Service Engineer
Carbide Sales Division
FIRTH STERLING, INC.
Pittsburgh, Pa.

THE APPLICATION OF CONVENTIONAL TECHNIQUES to the machining of a broad range of materials falling under the general classification of high temperature alloys has in the last few years become a critical matter to the tool engineer. True, for a longer period of time we have had to face a machining problem on a group of materials with similar machining characteristics, but the advent of the jet air age has greatly increased the volume of work to be done and has made it necessary for a vastly greater number of people to familiarize themselves with the problem so critical to national defense.

So long as the efficiency and performance of modern aircraft depends on the ability of engine components, and to a somewhat lesser degree air frame parts, to maintain a high order of structural strength at elevated temperatures, it is not likely that the problem facing the tool engineer today will be any easier tomorrow. On the contrary, with aircraft designers constantly demanding better high temperature materials, and with our metallurgists constantly striving to satisfy these demands, it is reasonable to assume that those problems which are plaguing us today will be greatly magnified tomorrow.

Even today the general subject of machining of high temperature alloys is extremely broad based because of the many chemical compositions involved, the wide range of physical properties possible with each composition resulting from heat treat and cold work, and the many cutting operations which must be performed on each alloy in any condition. This broad base would necessitate the writing of several volumes to give full coverage to all the details worthy of discussion, and in the present short piece it will be necessary to confine our thoughts to certain basic overall considerations.

In attempting to rationalize the inherent difficulties encountered in the machining of these alloys, it is apparent that we are confronted with a number of phenomena, which, while they may not be exclusively peculiar to these materials, do play such an important part that they are worthy of special emphasis.

As mentioned, there are many basic chemical analyses used in the make-up of these materials for high temperature service. These range from comparatively low alloy steels through some of the more common stainless steels, and now include iron base and nickel base alloys designed especially for today's rigorous needs.

	COMPOSITION							
Alloy	**C**	**Mn.**	**Cr.**	**Ni.**	**Mo.**	**Fe.**	**Ti.**	**Cu.**
414	.15		12.5	2.0		84.0		
19-9 DL	.32	1.0	19.0	9.0	1.35	65.0	.25	
321	.08	2.0	18.0	10.0		69.0		
16-25-6	.10		16.0	25.0	6.5	60.0		
A-286	.07	1.5	15.0	26.0	1.25	52.0	2.0	
Discalloy	.03	1.25	13.0	26.0	3.0	54.0	1.6	
K Monel				66.0		1.0		29.0
Inconel X	.08	.70	15.0	70.0		7.0	2.5	

Figure 1

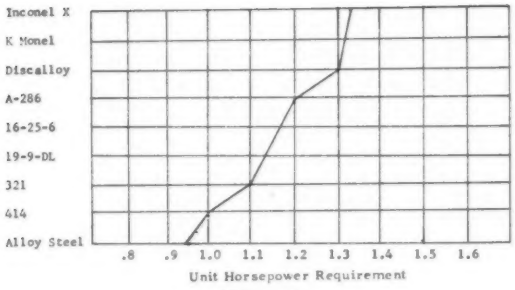


Figure 2

Figure 1 is included merely to show a cross section of the many possible analyses represented in the general picture.

No attempt has been made to list all possible alloys in this field, but it is felt that those which are listed will serve to represent the others. The reader will note a lack of similarity between most of the grades listed here. However, there is one common element, nickel, and the various grades have been listed in the order of their nickel content.

The difficulty with which high temperature alloys are machined is attributed in large measure to this nickel content. Certainly, there are other prime causes such as other chemical elements, the severe tendency to work-harden, poor thermal characteristics, etc. But, for the purpose of our first consideration, we will use the nickel as a criterion.

Figure 2 is presented to illustrate the relative machinability of the alloys shown with respect to each other and with respect to the more common alloy steels.

The unit horsepower values shown are applicable to a given system of cut characteristics and are, of course, subject to change with any change in these characteristics, as well as with differences in other factors, such as heat treatment, size of the part, tool geometry, etc.

Because horsepower required to perform a cutting operation is an accurate reflection of the cutting forces acting on a tool, it is now obvious that the forces involved in the cutting of high temperature alloys are considerably in excess of those met with in more common applications.

It may be well at this time to form a picture of the several forces acting on a cutting tool in operation. Figure 3 portrays the three active forces and their resultant.

It is the hope of the author that the contents of this article will serve in some measure to help the reader understand these forces and to provide some assistance of practical means to resist them.

To begin with, the widespread use of these materials is of comparatively recent origin, and because there has been little published in the literature on practical machining details, these form today a highly controversial subject. However, a careful analysis of the situation reveals that all these alloys are characterized by a number of common attributes.

1. The High Shear Strength. This is reflected in a high order of cutting forces acting on the tool. This condition has a necessary effect on any practical approach to a machining job.

a. Obviously, sufficient power must be delivered from the motor to prevent stalling, eliminate chatter, and provide a smooth, uniform rate of cutting. If this power is not delivered, the result will be premature chipping of the edge of the tool, poor finish on the work, high tool cost and excessive damage to the machine tool bearings and ways.

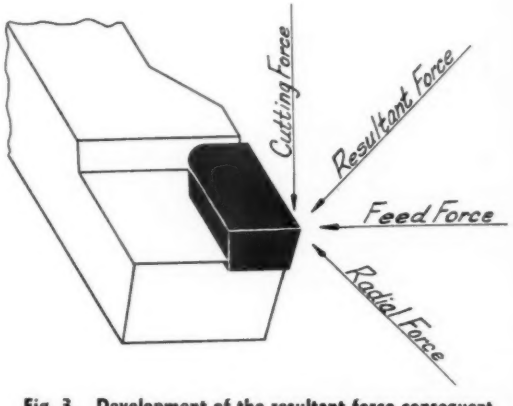


Fig. 3. Development of the resultant force consequent to the radial, feed, and cutting forces acting on a cutting edge.

b. For the same reasons as above, the machine tool work fixtures and cutting tool setup must be of rigid design and construction.

c. Cutting tool shanks must be of ample proportions to prevent structural failures and to eliminate all vibration from the operation. The use of carbide inserts mechanically held in heat treated shanks is recommended. The tool overhang must be kept to an absolute minimum to prevent vibration.

Generally speaking, the machinability index on these alloys is higher in the solution-treated or annealed condition, but in this condition they tend to be more "gummy", with the result that they have a great tendency to load up on the cutting tool. It is then necessary to pay more attention to tool geometry and finish to minimize this condition.

2. The cutting of high temperature alloys is nearly always done in the presence of very high operating temperatures as a function of their high shear strength and poor thermal conductivity. The result of this high concen-

tration of heat at the cutting tool and chip interface is accelerated chemical activity in this immediate area and a built-up edge, as illustrated in Figure 4 (a).

The built-up edge is actually a localized welding of the chip to the cutting tip, the welding having been facilitated by the combination of heat and pressure. The continual passage of the chip over this area causes these minute weldments to break off, and in so doing, a very small particle of the tool tip is fractured and carried away with the chip.

The result of this action, repeated over and over again, is a mechanical erosion to the point where a groove or crater is worn into the face of the cutting tool. This is shown in Figure 4(b).

If allowed to continue, this process will create a reduction in the flank angle (α) of the leading edge of the cutting tool to the extent where it will no longer support cutting forces and fracture will occur, as illustrated.

There are, of course, certain preventive measures which we can take to postpone tool failure because of high operating temperature.

a. Keep the cutting edge as cool as possible through the use of a constant flood of coolant. Heavy duty soluble oils or detergent type emulsion are quite effective.

b. Keep tool as sharp as possible. It is advisable to remove tools from service for regrinding in the case of brazed tools or for indexing of button or slug type tools before the full extent of possible life has been realized. The maintenance of sharp edges will pay off in better product and lower tool cost in the long run. This is particularly true when machining lighter sections where there is a danger from distortion, due to the increase in cutting pressures which dull tools would create. Dull tools will also have an adverse effect on surface quality of the work.

c. Use the best combination of cutting tool material and tool geometry possible.

Basic grade recommendations will be made later. A combination of 0° back rake and at least 6° side rake is usually quite effective.

Normally, relief angles on the carbide are set at 6°, but in cases where trouble can be attributed to edge chipping, it will be helpful to reduce the relief angle to about 3° for a distance of from $\frac{1}{32}$" to $\frac{1}{16}$" under the cutting edge.

3. In the forged or cast condition these alloys tend to be badly scaled. This scale is extremely hard and tightly adherent.

The constant impact of this scale on the sharp cutting edge of a carbide tip causes mechanical failure of the tip through chipping at the scale line before the cutting point, itself, has had an opportunity to wear out normally. This premature failure can be postponed effectively by drastic honing of the cutting edge of the tip at the depth of cut, or scale line, as shown in Figure 5.

The radius or chamber honed on the edge may be as much as 0.030" without an adverse effect on the operation.

Actually, for better tool life and to minimize build-up, the edges in other cutting areas should be lightly honed to about 0.002" to 0.004" radius or chamfer.

Whenever possible, it is important to establish the depth of cut at a value which will insure keeping the nose of the tool buried under the scale at all times.

4. These alloys are extremely abrasive and exhibit severe wear on tools. To resist this wear, the hardest possible cutting material should be used, provided, of course, that excessive tool breakage can be avoided.

Cutting of a chip from these materials is usually accompanied by the formation of a secondary shear, and harder carbides are effective here, as well.

5. In machining, the high temperature alloys tend to work-harden badly in the chip and in the body of the work under the cut.

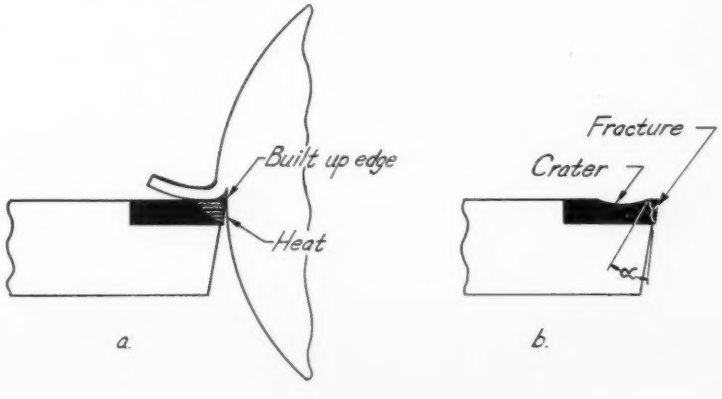


Fig. 4. High concentration of heat results in (a) the built-up edge and (b) the subsequent fracturing and cratering.

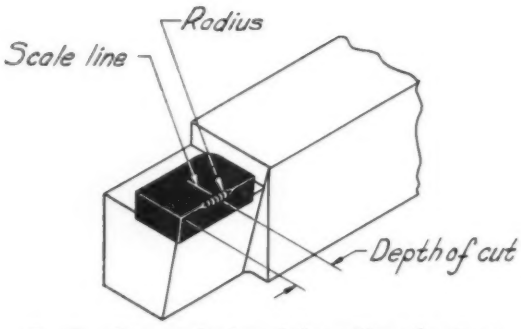


Fig. 5. Generous honing of the cutting edge to as much as a 0.030" radius at the scale line or depth of cut will prolong tool life without adverse effect on the operation.

For this reason, secondary or finishing cuts should be avoided, if possible. When finish cuts are necessary, the depth of such cuts should be at least 0.010" to insure getting the cutting tool in operation under the glazed and hardened surface skin.

We have found that the size of the nose radius has a marked effect on the extent to which work-hardening takes place. Figure 6 is presented to illustrate this effect. As the chip thins around the large nose radius until its thickness becomes zero at the point of tangency of the radius with the end cutting edge angle, there is an increasing tendency to wedge the chip between the cutting tool and the work. This wedging has the effect of work-hardening and glazing the surface immediately under the cutting tool, increasing the difficulty of any subsequent operations which may be required. The comparatively broad contact of the larger nose radius has the same effect.

The reduction of the nose radius to the smallest possible size will go far to minimize the surface hardening problem. Actually, very effective results have been achieved with sharp corners used in conjunction with steep lead angles over a wide range of operations, including the rough skinning of forged billets.

While on the subject of tool geometry, a

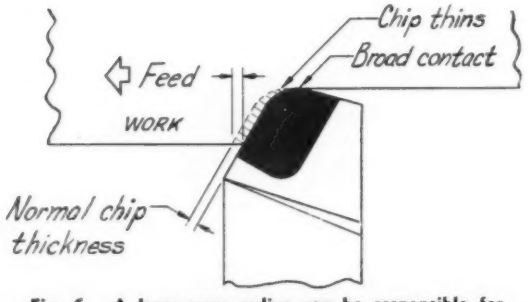


Fig. 6. A large nose radius can be responsible for chip wedging and work hardening. Reducing nose radius to the smallest possible will go far to minimize the surface hardening problem. Actually, sharp corners and steep lead angles give very effective results.

word regarding the side cutting edge angle would be in order here. The machining characteristics peculiar to high temperature alloys make it advisable to use a fairly steep angle here, generally in the neighborhood of 30°. Refer to Figure 7.

For one reason, because of the high shear strength and resultant high loads on the tool, taking the initial impact load at a point "A" well back of the weak nose will prevent much undue tip breakage. As the tool progresses into the work at the start, the load is built up gradually until the full depth of cut has been reached.

A side cutting edge angle also thins the chip for a given axial feed "F", resulting in a smaller load on the tool per unit of area. The total metal removal per unit of time, again with a given feed, is not changed, because of the fact that the chip is longer than it would be if a straight sided tool were to be used.

This lead angle also provides a greater volume of carbide at the cutting point, which allows for better dissipation of heat generated at the point. The greater nose angle "B", which naturally results, also contributes mate-

Also see "Machining Work-Hardened Alloy Steels" by W. M. Halliday, Jan. '56, p. 64, and Feb. '56, p. 87.

rially to greater strength of the tool where strength is most needed.

6. Chipbreakers. This is another detail of tool geometry worthy of careful consideration. Figure 8 (a) represents the conventional step type chipbreaker, most commonly used in ordinary work. Because of the extreme resistance of high temperature alloys to any attempt to change their shape or direction of movement, this type of breaker will usually not give satisfaction. The shoulder jams the chip, causing too tight a curl. Because of the jamming, much energy is wasted in producing plastic deformation in the chip, as evidenced by a rippling of the surface of the chip and an unnecessary thickening. The result is an increase in power required, higher tool forces, chatter and poor work surfaces.

A chipbreaker, such as that illustrated at "b" in Figure 8, will give better results. It provides a stronger tool, a smoother flowing chip, reduced tool pressure and operating temperature, less built-up edge.

The business of machining these alloys has in the last few years posed a real problem for Firth Sterling Inc., not only because of their interest in carbide applications, but also because they are one of the country's leading producers of high temperature materials. In order to properly prepare forged billets for

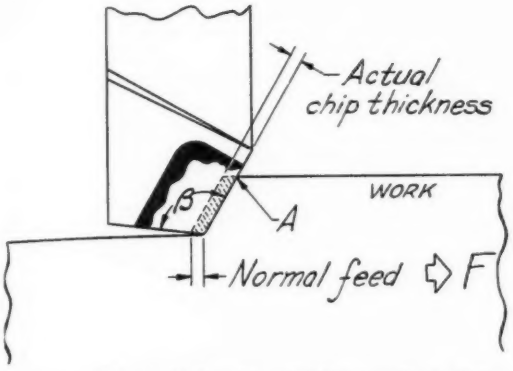


Fig. 7. The machining characteristics peculiar to high temperature alloys justify a side cutting edge angle in the neighborhood of 30°. Thereby, taking the initial impact load at point "A" well back of the weak nose will minimize tip breakage.

aircraft component manufacturers, the question of rough machining had to be faced up to and answered. The result of a concerted effort to develop a tool which would most satisfactorily do the job is pictured in Figure 9.

This tool embodies many of the features and principles already mentioned. The shank is very ruggedly made and is carefully heat treated to give optimum physical properties.

The cutting tip is mechanically held and a carbide anvil is provided for proper support and better heat dissipation.

The chipbreaker is placed well back of the cutting edge for smooth, comparatively loose chip formation. The breaker is indexable and is seated in a recess in the cutting tip to eliminate the possibility of chips or dirt working underneath.

A positive side rake is provided for freer cutting and a high (35°) side cutting edge angle is also incorporated.

Sharp corners are used on each of the six corners of the hexagonal indexable carbide insert.

Lastly, with an eye to the urgent need to keep these cutting tools as cool as possible, provision has been made to water cool the entire working end of the tool. An internal canal has been machined into the head of the tool in close proximity to the carbide components. Hose connections have been attached to allow for a constant flow of water into and out of the canal. The result is that heat from cutting operation is carried away as fast as it is generated, and the cutting tip remains cool. Longer tool life per edge is realized using this tool than is possible with any other method tried.

Carbide Grades

Stainless Steel. Generally, a general purpose steel cutting grade of carbide (C-6) will give best results on the 400 Series of stainless steels, while a general purpose cast iron grade (C-2) will work best on the 300 Series.

On any grade of stainless, best results on light secondary finish cuts will result from the use of the cast iron grades because of the abrasiveness of the work hardened skin and secondary shear.

High Temperature Alloys. Roughing operations are best performed with a general purpose (C-6) or roughing (C-5) steel grade, while lighter operations will require the use of a general purpose cast iron grade (C-2).

Cutting Speeds

Practical speeds cover a wide range, depending on work hardness, surface condition, analysis and nature of the operation, but in general, most roughing on stainless steel is done be-

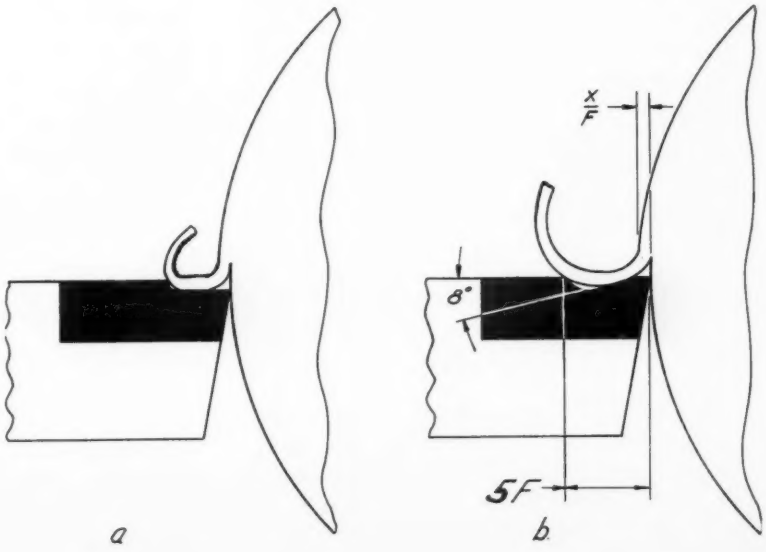


Fig. 8. The style of chipbreaker at (b) will give better results than the conventional one at (a). It (b) provides a stronger tool, a smoother flowing chip, reduced tool pressure and operating temperature, and less built-up edge.

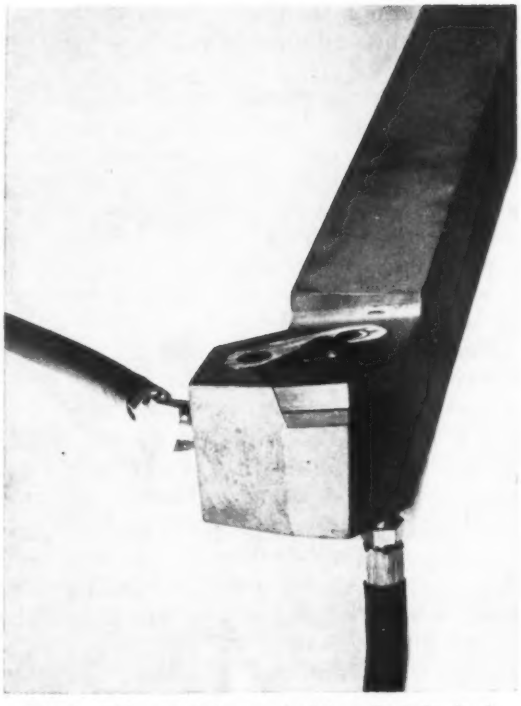


Fig. 9. This tool design resulted from Firth Sterling's extensive production of high temperature materials, and the furnishing of rough machined billets for aircraft component manufacturers. Water is piped through an internal canal in the head of the tool, and heat is carried away from the cutting operation as fast as it is generated. See text for all design details and performance advantages.

tween 125 and 250 sfpm and finishing between 200 and 375 sfpm.

For high temperature alloys, speeds are normally somewhat lower than those used on stainless because of greater hardness, toughness and surface scale.

Roughing operations are usually performed at 50 to 125 sfpm, while finishing speeds may range up to 225 sfpm.

Because there is a close functional relationship between high temperature alloys and titanium, a word on machining of the latter may be of interest here. The cutting of titanium is characterized by the following:

1. The presence of high operating temperatures at the tool and chip interface because of low thermal conductivity and because of a high unit pressure of the chip on the tool face. This high unit pressure is the result of very little plastic deformation in the chip, causing the chip to be thinner with a correspondingly smaller area of contact. The chip is naturally longer and this produces more abrasive rubbing at the area of contact.

2. The intense chemical activity of titanium at elevated temperatures. In operation, it has a tendency to alloy with almost all metals.

3. Titanium, in spite of low shear strength, is very abrasive.

Because of a high shear angle in the chip, a result of the slight plastic deformation, shearing forces are low, the principal cutting energy being expended in overcoming friction.

In consideration of these characteristics, there are a number of practical conclusions to be drawn, which will be helpful in machining.

1. Generally, the so-called cast iron grades of carbide give best results. Because of the alloying tendencies of titanium at elevated temperatures, the additional constituents in steel cutting grades of carbide may be unstable in the presence of metallic titanium. This conclusion would account for the known rapid erosion of steel cutting grades. Straight tungsten carbide grades used for cast iron cutting would, because of less alloying, offer lower frictional resistance to chip flow. This conclusion is confirmed by lower dynamometer readings on actual tests.

2. Mechanically held carbide inserts will dissipate the high concentration of heat at the tool and chip interface better than brazed tools; the braze layer seemingly acts as a heat trap.

3. Sharp tools will reduce cutting forces and operating temperatures.

In this connection, it has been found that side cutting edge angles of 6° used in conjunction with 0° back rake and a side rake of at least 6° are quite effective.

4. For general work, the following sfpm recommendations will be satisfactory.

	Pure Titanium	Ti-Alloys
Finishing	300	150
Roughing	35	65

These recommendations are, of course, subject to change with changes in job conditions.

5. The use of a copious flood of coolant is quite necessary. Water soluble oils in about a twenty-to-one solution have been found to be effective.

6. Never stop a cut with the tool in contact with the work. The alloying previously mentioned is usually present to some extent and stopping of the cut would result in a freeze at the interface, which would have to be broken when again starting up with resultant heavy tool damage. end

In further pursuit of this critical subject of machining high temperature alloys, we have an article destined for next month by William Hook, Ass't. Production Superintendent, Continental Aviation and Engineering Co. of Toledo. His article will deal with production problems encountered in aircraft components.

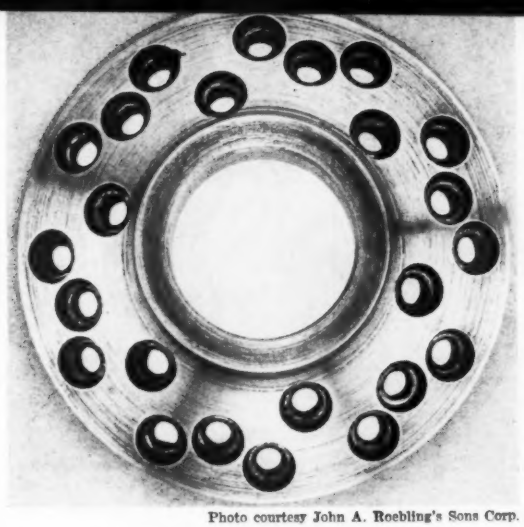


Photo courtesy John A. Roebling's Sons Corp.

Fig. 1. This rope weaving strand head is a steel disc having 24 carbide guide rings secured in countersunk holes by Bondmaster 620. In service there has been no indication that the bushings will move or come out of the disc.

Try Carbide Bonding with a No-Mix Epoxy

by Bernard Gould
Manager, Market Development
RUBBER & ASBESTOS CORP.
Bloomfield, New Jersey

A NEW DEVELOPMENT in adhesive technology — the single-component, 100% solids, epoxy paste adhesive — is apparently providing the long-sought-for answer to many of the problems encountered in the tool industry, particularly those concerned with the bonding of carbides to steel.

For many years, alert members of the metalworking industry have been investigating the possible use of high strength epoxy adhesives in applications where the heat of silver soldering, brazing and welding present direct or potential hazards to the quality of the finished product.

While it has been well established that these epoxies actually can provide the required strengths, such pastes were, up to very recently, available only as two-component systems consisting of a resin and a hardener. With that type of formulation, each component must first be carefully weighed and the two parts thoroughly mixed just prior to use, since the typical pot life of such mixed material is usually limited to two to three hours.

Adhesives of this type are well established in the aircraft industry, for example, where the unique characteristics of the materials being bonded (such as aluminum honeycomb cores), together with the advantages in obtaining the specific strength values demanded for aircraft applications, overcame the inherent limitations involved in working with specialized two-component systems.

This two-component mixing technique, however, has not lent itself to the type of mass production operations which are required for profitable operation in tool production and in other aspects of the metalworking industry.

New, Single-Component Epoxy Developed

Accordingly, while approval of epoxy adhesives in theoretical laboratory testing had been quite common throughout the industry, actual production usage lagged until the latter part of 1955 when the first successful develop-

New non-flowing, low-heat "chemical fastener" eliminates distortion and embrittlement in the critical joining of dissimilar materials, and offers possible cost savings of up to 90%.

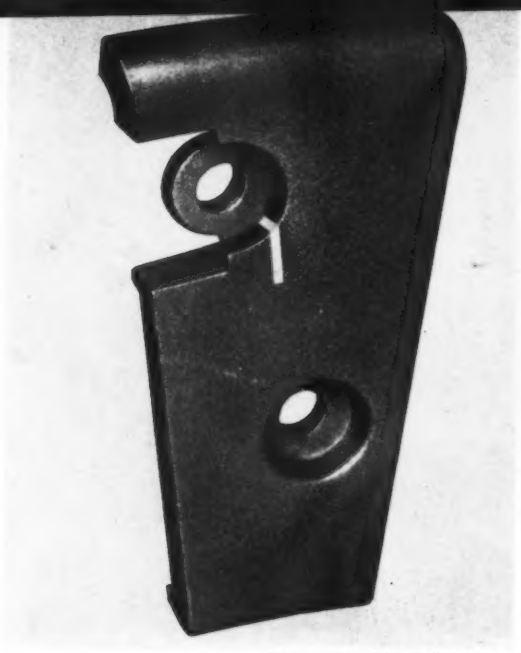


Photo courtesy Riley Stoker Corp.

Fig. 2. Used in coal pulverizing equipment, this "2nd effect" wearing plate has a tungsten carbide insert bonded with a one-part epoxy adhesive.

ment of a one-part paste epoxy, Bondmaster M620, was achieved by Rubber & Asbestos Corp., manufacturers of industrial adhesives, of Bloomfield, New Jersey.

For the first time it was now possible to overcome the physical difficulties involved in handling two-component systems in mass production. Although not as strong as the very best of available aircraft adhesives in peel strength and in its ability to withstand continuous service at high temperatures, the new adhesive development offered an excellent balance of good all-around strength properties. Based upon the number of successful plant use reports, these strength characteristics appear to be more than sufficient for carbide wear strip applications and similar conventional metalworking use.

The availability of these desirable properties promptly initiated a trend toward re-evaluation of adhesives as a fastening method. As a result of this re-examination on the basis of the use of a one-part product, there is today an acceptance of epoxies for tool component bonding in a continually growing number of plants throughout the country.

The new Bondmaster M620 is a 100% solids epoxy which means there is no wait for solvent evaporation before mating the sections to be joined. In this new formulation, the adhesive chemists were able to introduce recently developed hardener systems and an entirely new type of stable, compatible thixotropic agent. This combination enabled Rubber & Asbestos to create a paste adhesive which offers excellent storage stability, almost unlim-

Fig. 3. A screwdriver blade serves to apply the one-part thixotropic paste adhesive to the bearing race gage. Since the adhesive will not flow during the cure, thickness of coating determines thickness of "glue line" in finished assembly.

ited "use life," and a wide variety of practical curing cycles.

The broad range of possible curing cycles permits the user to determine his own method of application, within specified limits, depending upon the maximum amount of heat which he can tolerate in the making of the assembly or, if his problem lies in the opposite direction, upon the required speed of application if available curing time represents his most important limiting factor.

ALTERNATIVE CURING CYCLES

Temperature in the Bonding Layer	Minimum Curing Time
535°F	7 to 10 minutes
500°F	12 to 15 minutes
450°F	20 to 25 minutes
400°F	40 to 50 minutes
350°F	1½ to 2 hours
300°F	4 to 5 hours
260°F	20 to 24 hours

Only low "contact" pressures — on the order of 5 to 15 psi — are required.

Eliminates High Soldering-Heat Dangers

Conventional bonding techniques for the carbide assemblies illustrated throughout this article would normally have involved the use of silver solders whose application temperatures range in excess of 1,000°F.

Consequent high heat hazards are highlighted in the problems which were faced in the application of tungsten carbide bushings to steel discs at John A. Roebling's Sons Corp., Trenton, New Jersey.

In one typical application there, 24 carbide guide rings, Figure 1, had to be secured in countersunk holes on three different diameters of 2¾" O.D. by ¼" thick strand head.

Because of the great dissimilarity between the two materials involved, the relatively high heats demanded by silver soldering caused distortion and possible embrittlement unless extreme care and proficiency were used in the soldering operation. This demanded extreme

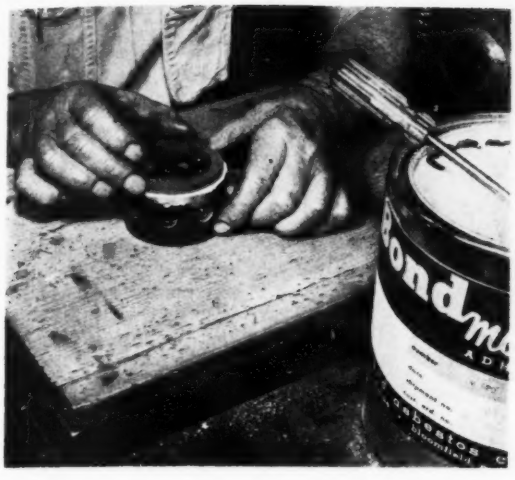


Fig. 4. Positioning of carbide ring on gage after adhesive is applied.

skill in the wielding of the acetylene torch, in the type of flame movement used by the welder; in the proper flow-out of the solder; and upon the extent of care in post-cleaning of the flux residue.

The engineers at Roebling swiftly realized that the use of an adhesive applicable as a smooth-spreading paste in its "as received" condition, would eliminate the human variables involved in conventional bonding.

After careful preliminary evaluations, it was decided to supplant conventional silver soldering by the new Bondmaster M620 for this application. Reports Roebling: "The equipment has been used in our rope shop and gives no indication that the bushings will move or come out of the steel disc."

Greater Uniformity Insured

Since effective silver soldering in the tool industry calls for peak proficiency on the part of the welder, quality standards may vary with the ability and experience of the individual operator involved. The minimization or elimination of this possibility of non-conformity to specified standards has been a basic target of design and production engineers in the industry for many years.

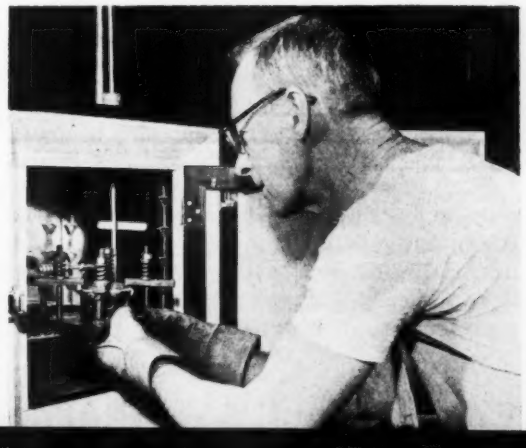
Still other considerations in conventional fastening methods are those involving the possible entrapment of soldering flux. There is an unavoidable tendency toward corrosive action unless careful (and time-consuming) cleaning procedures are followed. As a result, here, too, uniformity in mass production is extremely difficult to pre-establish with any certainty since it is once again directly related to the proficiency and conscientiousness of the employee involved and of the supervisory personnel.

In the very same way, the normally advantageous "quick flow" characteristics of silver solders demand experience in maintaining close control by the production worker. Relatively precise techniques must be enforced in order to hold this flow within those areas for which it is meant.

It was the search for a means of eliminating these factors which spurred adhesive chemists toward further developmental work on epoxies. As a direct result, the current availability of a bonding material which is spreadable by brush or spatula and which lends itself to complete control in every phase of application has led to comments like those of Mr. Charles H. Brenner, Divisional Plant Engineer of Roebling's: "This material provided a simple and efficient means of bonding in comparison to the silver soldering and brazing, which have been used in the past."

Fig. 5. Jig is used to hold carbide gage ring in position. Clamps apply sufficient pressure to enable assembly to be put in oven without disorientation. Mere contact pressure is required in effecting bond. There is no need for elaborate bonding presses when 100% solids epoxy adhesives are used.

Fig. 6. Jig with assembled gage is placed in Cenco electric oven where curing takes place at 149°C. Curing time varies with size of carbide insert. Post-curing within recommended limits does not adversely affect the bond so that removal from oven is not a critical time factor.



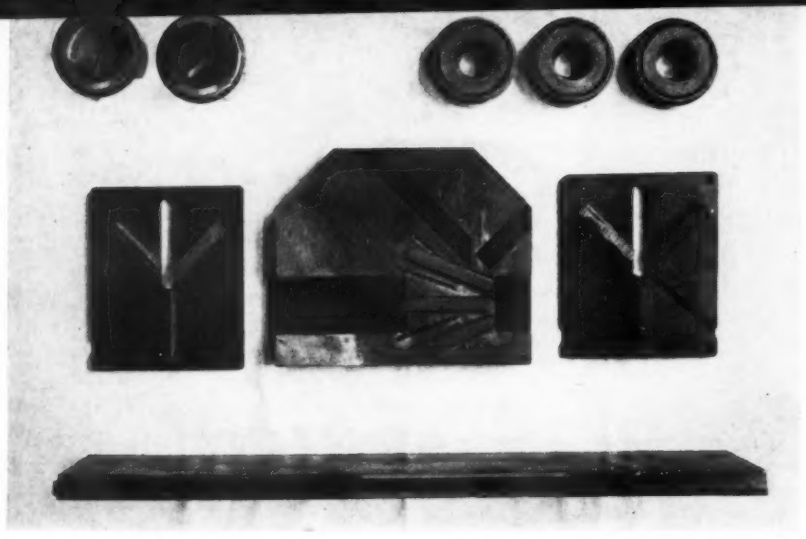


Fig. 7. Typical parts having carbide segments bonded with Bondmaster M620. Long bar at bottom is a wear bar from a Cincinnati centerless grinder.

The three center pieces are race gages from automatic gaging machines. Races revolve on carbide inserts while being gaged.

The upper three wheels are honing rollers having carbide packets bonded around each wheel.

The upper pair of carbide-bonded parts are backing plates from a grinding machine.

One-Part Adhesive Lends Itself to Mass Production

The elimination of so many of the variables encountered in conventional bonding, and the greatly simplified application requirements, together with the relatively low curing temperatures (260°F to approximately 535°F) of the new Bondmaster M620, now makes it possible to "upgrade" and to simplify an entire phase of metalworking mass production.

The new one-part resin mixture may be applied directly from the shipping container as an easily spreadable paste, about the consistency of a moderately firm cold cream. Spatula, brush, squeegee or even a screwdriver blade can now replace bulky oxy-acetylene equipment.

Thixotropic Characteristics

The soft, buttery consistency of Bondmaster M620 makes it extremely easy to spread smoothly and evenly. Its thixotropic quality enables it to maintain its form once applied so that it does not flow or drip during the curing cycle regardless of which of the recommended curing cycles is adopted by the tool manufacturer.

In other types of joining, this unique thixotropy makes the new paste adhesive particularly effective for "poor fit" and similar void-filling applications in addition to its primary advantages where the dripping or running of the bonding agent must be controlled within set boundaries.

Riley Stoker Increases Service Life 250%

Riley Stoker Corp., of Worcester, Massachusetts, manufacturers of steam generating and fuel burning equipment for public utility, industrial power and heating plants, have used Bondmaster M620 to secure wear-resisting tungsten carbide inserts, Figure 2, in the "2nd effect" wearing plates used with Riley "50" Pulverizers.

"Although the 2nd effect wearing plates have a high alloy content", reports Riley Stoker, "with some units, circumferential grooving was occurring just below the pulverizing elements when used with some of the higher abrasive coals. The wear was caused by a high concentration of coal particles in a dust cloud concentrated at this point. After a thorough study of the problem, a new wearing plate design was developed which incorporated an insert of tungsten carbide installed at the point of wear and grooving. Initial methods involving the use of silver solder to secure the tungsten carbide inserts proved impractical for various reasons. Tests were made using Bondmaster M620 and it was established and proved to be the most efficient and economical adhesive for this purpose."

They continue: "Bondmaster M620 is applied to the cored slot in the wearing plate and to the tungsten carbide insert before being inserted in position. The assembly is then placed in a 300°F oven for approximately four hours. Upon removal from the oven the castings are allowed to cool at room temperature and then the Bondmaster M620 is checked for proper hardness with a sharp pointed tool. Following inspection, the wearing plates are ready for assembly.

"This new wearing plate design", concludes the report, "has increased life of service by at least 2½ times."

Bearing Manufacturer Ups Carbide Insert Life from One Week to Six Months

Diversified applications of the new adhesive in other areas of metalworking manufacture indicate still other fields wherein adhesive bonding may be expected to supplant certain types of soldering. The "case history" illustrated in detail here, Figures 3 to 6, is that of a leading manufacturer of roller bearings, who

maintains extremely close tolerances in production and whose processes involve constant, close quality control.

In that plant, surface wear constituted a serious problem on much of the equipment on which the parts were continually being automatically gaged. As the backing plates in the gages wore down, the measurements were thrown off. Originally, the metal inserts were welded to the plates but these inserts, too, it was found, wore down too swiftly. Carbide inserts were then substituted because of their excellent wearing qualities.

While the carbide inserts apparently offered an ideal solution to this problem, the brazing or silver soldering of the carbide to the metal presented what appeared to be an insurmountable problem since it was found that the amount of heat necessary to braze or solder to the metal distorted and split the carbide. Further, it was determined that if the actual heat input while soldering did not cause the split, the resulting cooling process, because of the differing coefficients of expansion involved, caused splitting after the job was completed. Accordingly, the results were extremely uncertain and carbide inserts which had been soldered or brazed lasted anywhere from a day to a week.

Technologists at this bearing plant were among the first to recognize the advantages offered by the lower heat demands of the thixotropic one-part paste adhesive. They swiftly determined that all uncertainty about carbide splits from warped metal could be eliminated since extreme heat would be completely avoided during the bonding operation, regardless of the skill of the bonding personnel.

In one typical application, Figure 7, carbide inserts are joined to a Cincinnati wear bar with Bondmaster M620 and cured for about six hours at a temperature of 149°C. The average life of carbide inserts thus applied is currently reported to be in excess of six months as compared with former one day to one week stability.

Limitations of Adhesive Bonding

Certain limitations, it must be noted, are involved in the use of adhesives in the tool industry. Primarily, these are concerned with the amounts of peel strength required in the bond and with the level of elevated service temperatures at which the bonded assemblies are meant to perform. Epoxy adhesives, as a class, while exhibiting satisfactory block shear and tensile shear strengths, are limited in their peel characteristics in carbide tool work. Accordingly, despite the fact that block shear strengths of up to 8,000 psi have been reported by users, it is extremely doubtful whether this new bonding method would lend itself to many types of carbide **cutting** inserts where enormous peel resistance (on the order of welding strengths) is required. On the other hand, wear plate applications which involve substantially lower peel strength requirements are apparently unaffected by this limitation.

Similarly, the thixotropic nature of the material, while of a definite cost advantage in the elimination of "post-cleaning" labor and time, nevertheless precludes not only all capillary flow but even those normal free-flowing characteristics which are a basic characteristic of silver solders. On the other hand, the fact that the new adhesive will **not** run or drip during cure makes it possible to lay down the adhesive in the exact position desired for the finished assembly with assurance that the position and the thickness of the "glue line" will remain virtually unchanged from the moment of application until completion of the assembly. And, of course, all post-cleaning is entirely eliminated.

Cost Factors

Accordingly, while the new adhesive system was not intended to supplant all conventional joining methods by any means, the experience of the firms now using this new "chemical fastener" definitely indicates that the one-part 100% solids epoxy adhesive can and does replace much silver soldering and certain types of brazing where ease of application is important and where susceptibility to high heat distortion is a critical factor.

Accordingly, a comparison of the price structures of the two joining materials is of importance for the production engineer's and tooling engineer's cost analysis at this point.

Silver solders, as an average, are currently available within a price range of from $11 to $18 per pound. As opposed to this, Bondmaster M620 in production quantities is currently priced below $2 per pound.

It is evident, therefore, that on a pure "cost-of-raw-material" basis, savings of as much as 90% are possible if the substitution between the two systems can be made.

Further, despite the fact that the use of adhesives can, then, represent substantial cost savings, a major driving force toward the adoption of this material since the time of its introduction has been the ability to achieve greater uniformity in all aspects of application and the ultimate production simplification which this new "chemical fastening" method offers.

end

VERTICAL-SPINDLE SURFACE GRINDING

IN VERTICAL-SPINDLE SURFACE GRINDING, there is a choice between what some machine builders refer to as a multiple-pass machine and a single-pass grinder. The multiple-pass machine incorporates a single massive vertical grinding spindle, in connection with which it may be necessary for the work to be passed beneath the wheel several times to do the required job.

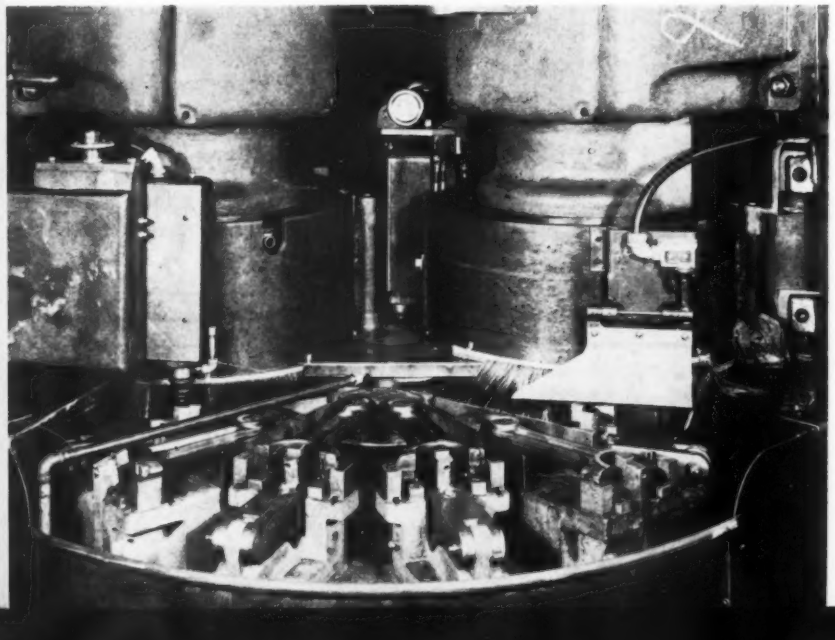
The single-pass machine may incorporate two, three, four or five vertical spindles, the general idea being use of a single rotary table or chuck, indexing each workpiece under the various spindles progressively. With a continually-larger proportion of work to be surfaced being routed to heavy-duty surface grinders rather than to planers or millers, an exceedingly wide range of surface grinding is performed. The greatest advantage of the vertical-spindle type of machine, however, is on parts of relatively-small area, having lengths and widths sufficiently small to throw them within the working range of a rotary-table or rotary-chuck grinder.

Whether a single-spindle or multiple-spindle unit is employed, any one or all of the spindles may be equipped either with a cylinder wheel or with one of several designs of segmental wheels. Regardless of whether a cylinder wheel or segmental wheel is employed, grinding is performed by the flat edge of the end of the grinding component.

Under these circumstances, grinding characteristics are completely different than where wheels of peripheral type are used; with a cylinder or segmented wheel, a large area of abrasive is continually in contact with large-area work, as against theoretical line contact where the periphery of a wheel is used for grinding. Very frequently, heavy cuts are taken on vertical-spindle grinders, ranging anywhere from $\frac{1}{16}$" to $\frac{1}{4}$".

Thickness of the cut which may consistently be taken is largely determined by area of contact between wheel and work. Where workpieces are of such nature that such area of contact is small, much less heat will be generated, and heavier cuts become feasible, with other things equal. Sometimes, where area of contact between wheel and work is very small, cuts much heavier than $\frac{1}{4}$" can be removed advantageously. Obviously, this is not to say that relatively-small cuts are not handled with equal facility. Where cuts are relatively small, the operation can be speeded accordingly.

In cases where a rotary table is used to carry workpieces beneath succeeding vertical grinding spindles, work-holding fixtures are often designed for automatic clamping and release of the work. Surfacing of the sides and joints of connecting rods constitutes an important instance of such grinding. Where machines incorporating multiple vertical spindles are used for grinding the sides of connecting rods, the work-holding fixtures are usually arranged so half of them hold the rods with one side up; the other half with the remaining side up. Thus, both sides of the rods are surfaced in the same operation, with close tolerances held. end



Close-up view of multiple vertical-spindle production grinder, surface grinding sides of connecting rods. The revolving table carries the workpieces under the different wheels progressively. Arranged around the periphery of the revolving table are stationary cams, which actuate fixture elements for clamping and unclamping the work.

Courtesy Mattison Machine Works

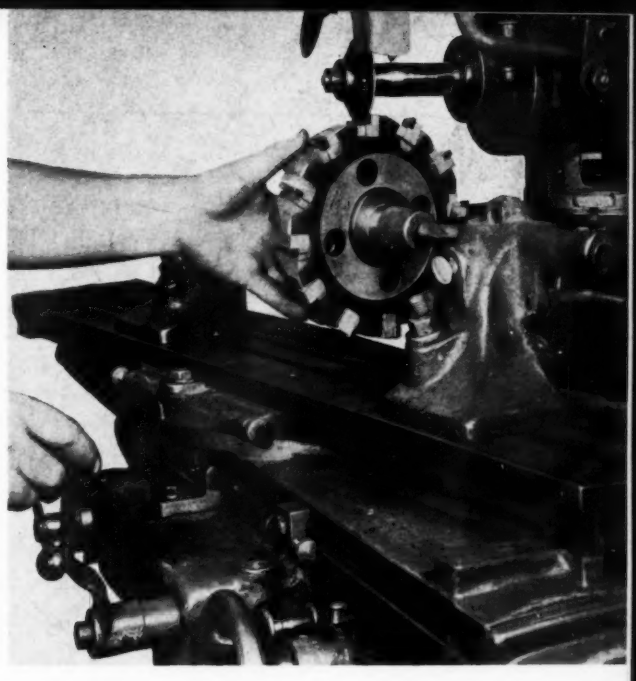


Fig. 1. Before attempting to sharpen a carbide tipped cutter, look it over carefully to determine how much stock removal is necessary to free it from all defects. Usually, a combination of facing to remove the crater and OD sharpening to remove the wear land will give the best tip life. The facing operation can be done either between centers or from a work head on any universal grinding machine.

40 Pointers for Milling with Carbides

THE 40 POINTERS GIVEN HERE should be helpful to tool engineers and shop supervisory personnel. They briefly highlight the more important fundamentals to remember when tooling up for or milling with carbides. The list is not complete, of course. No list could be. Observance of these rules won't eliminate all milling troubles. But they will eliminate 90% of the most common obstacles to getting the most out of milling with carbides.

The Machine Itself

1. Be sure it has ample power for the job under consideration.

2. It should be in good running condition, with gibs tightened to remove all play from the table.

3. Eliminate backlash from the table feed. (If your cutter is mounted on one of the newer horizontal machines, the lead screw will have a backlash eliminator to prevent the workpiece from being pulled into the cutter.)

Cutter Drive and Arbors

4. When flywheels are needed to minimize vibration, mount these as close to the cutter as possible.

5. Arbors should be of proper size. There seems to be a tendency to use arbors that are too small when milling with carbides. Remember, table travel is four to five times faster than when milling with high speed steel cutters; thus more arbor rigidity is required. As a guide in arbor selection, keep in mind that the rigidity of an arbor varies as the fourth power of its diameter. In other words, the rigidity of a 2″ arbor is three times that of a 1½″ arbor.

6. The taper shank should be free from nicks or burrs for a snug spindle fit.

by

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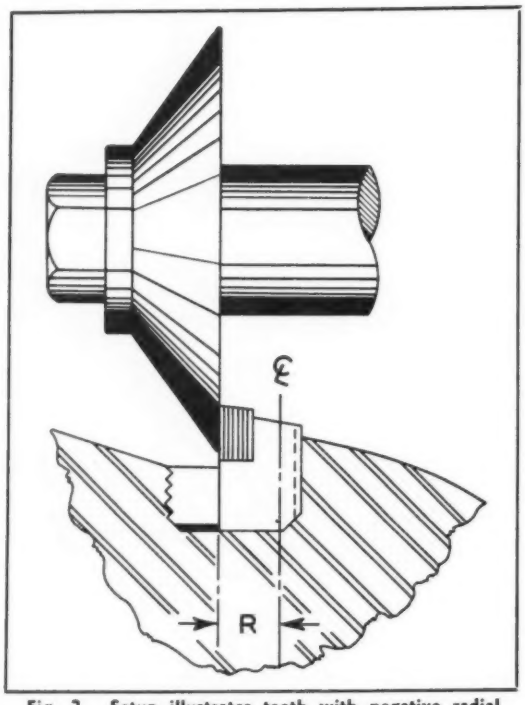

Fig. 2. Setup illustrates tooth with negative radial rake. Adjust the height of either the table or grinding head so the wheel covers the carbide tip only.

7. Arbor should run true.

8. Driving keys should be heat-treated quality steel of the right size.

9. Collar diameters should be as large as the hub of the cutter, with faces smooth and parallel.

Fixturing

10. In designing a fixture, try to "drape" it around the part to get maximum rigidity. Keep in mind the faster table travels being used.

11. The fixture must clamp the work securely and give full support under the cut. This support is most essential in frail workpieces.

12. Keep overhang to a minimum.

13. Direct cutting pressures away from clamps or movable jaws, and toward the most rigid part of the fixture.

14. Clamp the part in a downward direction in the direction of the feed.

15. Design the fixture base large enough to withstand the longitudinal, axial and vertical forces acting upon it.

16. Give special consideration to the axial force when extreme corner angles are used.

17. Streamline fixture design to enable chips to flow from the fixture naturally by gravity.

Chip Control

18. Provide proper guards to control the danger of flying chips.

19. Be careful that chips don't gather at locating pads, clamping pads or have a chance to accumulate where the cutter teeth enter the part.

20. Watch out for pinching of chips between the tool and the workpiece. The cutting edges can be nicked easily this way.

21. When milling a gummy-type material, use a wire brush continuously rotating lightly against the cutter's edge to remove chips.

Conventional vs. Climb Cutting

22. Conventional cutting should be used where materials have a hard or scaly surface. Keep in mind that this method has a tendency to loosen the workpiece by lifting the work jig, table, etc. from their bearing surfaces. As the cutter revolves against the work it is forced away by the feed. This, in turn, has a tendency to spring the arbor. The action continues until the arbor overcomes the resistance of the work to the cutting forces and the tooth enters the work. Abrasive action and heat generated in conventional milling are usually more destructive to the cutting edge than the cutting action itself.

23. Climb cutting usually results in better finishes. When climb milling, keep all moving parts of the machine tight enough to prevent backlash or "pulling in". Extra quality, better production and longer tool life are well worth a little extra caution required for climb milling. Heavier feeds together with better finishes are possible because component parts are under a steady pressure. Cutter teeth have quick and positive entrance into new metal, there being no riding of previously milled surfaces and thus less abrasive action on the tooth.

TABLE I—Starting peripheral speeds for milling various materials with cemented carbide.

MATERIAL	STARTING SPEED SFPM
Aluminum & Magnesium	1000 up
Copper	1000 up
Brass—soft	1000 up
—hard	400
Bronze	400
Malleable Iron	350
Cast Iron—soft	275
—medium	250
—hard	200
Chilled Iron	100
Cast Steel	200
Steel—100 Brinell	450
—150	400
—200	350
—250	300
—300	250
—350	200
—400	150
Stainless Steel	400

REDUCE SPEEDS FOR:	INCREASE SPEEDS FOR:
• Hard materials	• Soft materials
• Abrasive materials	• Better finishes
• Sandy castings	• Small diameter cutters
• Heavy cuts	• Light cuts
• Heavy workpiece	• Frail workpiece
• Rigid setup	• Frail setup
• High nickel or manganese content	• Thread milling (50 to 100% over the above figures)
• Excessive land wear	• Excessive chipping
	• Saws

TABLE II—Starting feeds (feed per tooth) for cemented carbide milling cutters, for milling cast iron, steel and non-ferrous metals.

TYPE OF CUTTER OR CUT	START	GENERAL RANGE
Face Mill	.008	.005-.025
Straddle Mill	.008	.005-.025
Channel or Slot	.008	.005-.020
Slab Mill	.007	.005-.020
End Mill or Profiling	.004	.003-.010
Small End Mills	.002	.001-.005
Saw	.002	.001-.005
Boring	.007	.005-.020
Reaming	.007	.005-.025
Thread Milling	.002	.001-.005

(These are starting points only. Other variables will determine the best combination of feeds and speeds.)

INCREASE FEEDS FOR:
- Heavy cuts in a heavy workpiece well anchored
- Light slabbing cuts
- Abrasive materials
- Scaly surface conditions
- Excessive land wear
- Easily machinable metals
- Chatter

DECREASE FEEDS FOR:
- Frail anchorage
- Frail cutter
- Better finish on work
- Deep slotting cuts
- Where chips are unusually long and continuous
- Chipping of cutting edges

Speeds and Feeds

24. Cutting speeds should always be considered in basic terms of peripheral feet-per-minute rather than revolutions-per-minute. The larger the cutter diameter, the lower the spindle speed can be for the same cutting speed in feet-per-minute.

25. Check the physical properties of the material before attempting to select starting cutting speed. Then consult Tables I and II.

26. When milling the harder and tougher grades of steel lower cutting speeds will tend to increase cutter life.

27. When there is an indication of build-up of material at the cutting edge, increase the cutting speed to prolong cutter life.

28. Usually, milling with carbides should be three to five times faster in feed per minute than corresponding milling with high speed steel. To get best results — select starting speed from Tables I and II, and then try the next higher and lower speeds to determine which is best under existing conditions.

29. Use as high a feed-per-tooth as possible in relation to the part being milled as the overall setup will permit.

Cutter Sharpening

30. Consider a cutter dull when the wear land along the corner angle is about one thirty-second inch wide. Wider wear lands will cause rapid increase in cutting pressures with possible chipouts. This not only reduces life but also will put an added burden later on the cutter sharpening department.

31. Sharpening of carbide tipped milling cutters should be by fixed grinding. The grinding wheel should be set to remove the same amount of stock all around to insure identical dimensions on each set of cutting edges and balanced chip load.

32. Avoid removing an excessive amount of carbide per wheel pass. Resulting heat causes grinding checks, in turn resulting in fewer number of parts per grind. In finish grinding, it has been found that if stock removal per wheel pass is reduced to 0.0002″ to 0.0003″ there is not only a decided increase in the number of parts per cutter grind . . . but also a greater uniformity in the number of parts produced per cutter grind.

33. Keep a record of the date of each cutter sharpening and the number of parts obtained per cutter grind.

34. Best results will be obtained when sharpening if care is used in removing all previous wear on both the periphery of the cutting edge and the face of the tooth.

35. Cutter sharpening leaves a light grinding burr at the cutting edge. This should be

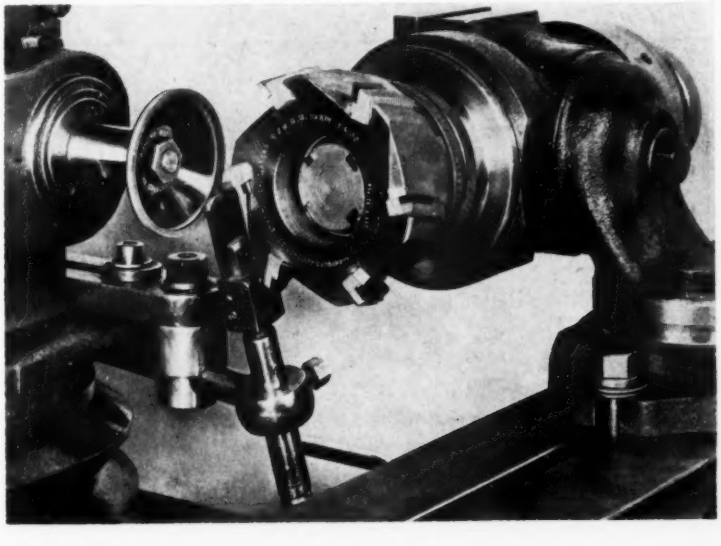

Fig. 3. Setup for grinding OD of a profile cutter from a work head attachment.

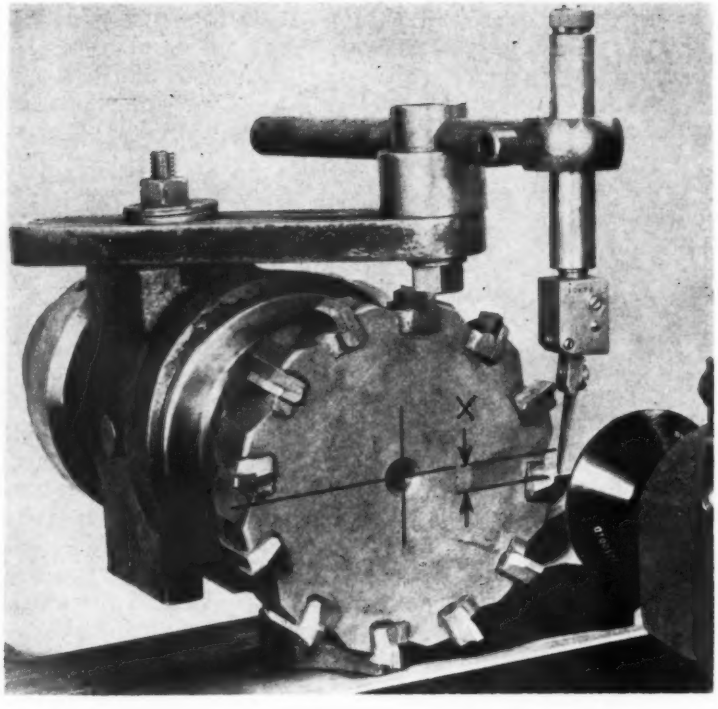

Fig. 4. In sharpening the end teeth of a cutter, the tooth face is parallel with the centerline of the cutter.

removed when milling steel by substantially honing the cutting edge with a 320 grit silicon carbide hone. Parallel the direction of honing with the cutting edge while the hone is held at about 35° to the tooth face. Honing makes a solid cutting edge that can withstand cutting impacts. Unless this is done, particles will break off the edge on contact with the workpiece, causing a rapid breakdown of the cutting edge.

36. Cutters used for milling cast iron and aluminum ordinarily do not require honing.

37. Keep the grinding wheel clean and free from loading. Use an oil mist or a gravity sight feed unit. This will ensure against overheating the carbide and developing grinding checks.

38. In grinding, an intermittent flow of coolant is worse than none at all.

39. Caution: When grinding carbide with a diamond wheel avoid contact with steel behind the carbide to prevent loading of the wheel and consequent overheating and cracking of the carbide.

Finally

40. Most carbide milling applications should be engineered.

end

Coming Soon:

"100 Ways to Save Diamonds"
"A New Analytical Tool for Machine Tool Replacement"
"Blanchard Grind at Higher (10:1) Feeds"
"For Better Brazing Start with the Fundamentals"

Your "vote" for the article in this issue of greatest interest to you will be most appreciated. Use the Inform-A-Gram card facing page 220.

Rules of the Road to

MULTI-DIAMETER HOLE ENGINEERING

by Frank Gable
Chief Engineer
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Detroit, Michigan

A SEGMENT OF TOOLING AND PRODUCTION that is the "grandaddy" of all modern day multiple tooling is the design and application of multiple diameter boring heads and cutters employing as many as 20 teeth performing a large number of operations in a single pass.

This oldest form of multiple tooling, boring head design and engineering, is still the least understood except as it relates to reaming. No comprehensive data has yet been compiled on this highly specialized subject. Such tooling has always been the exclusive realm of the "long experienced" engineer.

It has always been contended that each application of multi-diameter boring heads on steel is a special application requiring a tailor made solution and that this phase of tool engineering resists rule making of any kind. Actually, this is true to some degree with every kind of tooling.

Experience has taught that while there are no identical solutions to different application or design problems, a few definite rules of the road can be set down to minimize many of the pitfalls and reduce some of the "trial and error" in approaching specific jobs.

Lack of know-how, however, is not confined only to the **design** and **engineering** and **application** of this type tooling. The **economics** of such tooling and associated methods selection also require emphasis.

It may surprise many to know that even with today's advanced technology, potential manufacturing savings frequently "die on the vine" through failure to evaluate such tooling and methods on more than the initial cost.

The basis for evaluating the production and cost merits of this form of tooling is essentially the same as for any other — savings in direct and indirect cost. Naturally, any objective analysis must begin with the elimination of any preconceived ideas that " . . . it costs too much."

Without equating ALL factors supported by good day-to-day records, a true evaluation cannot be made. Experience has shown that even though this axiom is a foregone conclusion, it is one that is too often overlooked.

The justification for converting from present methods to multi-diameter, multi-bladed boring heads can be as varied as they are many. Any single factor of the formula for cost analysis can reveal sufficient cause. Note carefully that simplicity of tool design, in the case of boring, DOES NOT ALWAYS represent the most economical or efficient tooling . . . as the cost evaluation is likely to reveal.

Good tool design will have a more definite effect on cutting efficiency in the case of boring heads than any other tool type. Neglect of seemingly unimportant features, for example, may result in greater horsepower consumption by as much as 30%.

The number of operations that can be combined is limited only by the imagination of the tool or process engineer. In many cases, up to 20 operations may be combined into a single machine with a single, multi-diameter boring head.

Efforts to convert should be confined to multiple diameter holes that range from 1″ to 15″. While it is possible to apply multiple diameter boring heads on holes of larger diameters, there is a point of diminishing returns depending on the maximum production or the

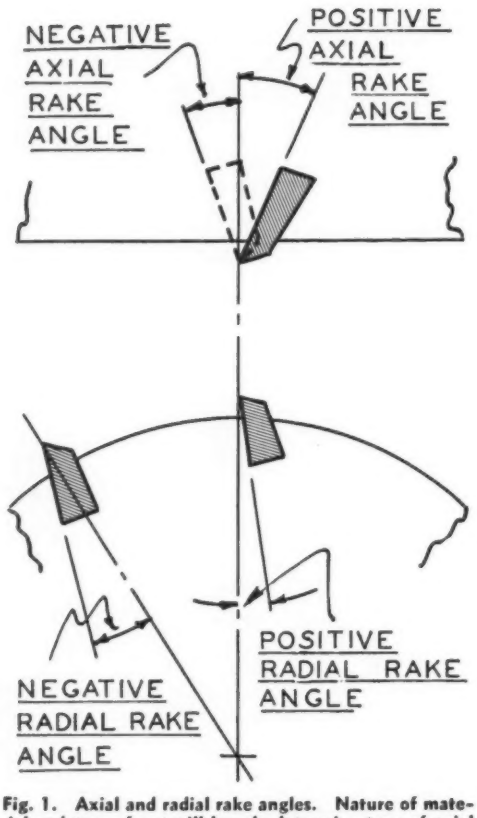


Fig. 1. Axial and radial rake angles. Nature of material and type of cut will largely determine type of axial or radial rake angles employed.

known life of the product design.

For the design engineer, it is imperative that a complete analysis of the workpiece be made paying special attention to the maximum and minimum tolerances of the green forging or casting, presence of hard spots, free carbon, nickel, etc.

Familiarity with the workpiece is a fundamental rule for any tooling operation, but it is known generally that too little attention is paid to this rule until real trouble begins. On boring applications, this can result in complete and costly failure of machine and tooling . . . regardless of the amount of horsepower available or the excellence of cutter design.

It's also important for the design engineer to know and to realize that economy and efficiency of maintenance of this type tooling will be determined — not after the cutter arrives in cutter grind, but — in the design stages.

There are additional data that the cutting tool designer should have at his fingertips but, in the main, they are the same requirements for any tool design: finish required, concentricity or relationships to be held between machined surfaces, depth of bore, etc.

Designing Boring Heads

The design of a multiple diameter boring head employing two, three or more sets of carbide blades or inserts, in many respects, is similar to engineering a single point boring bar application. However, the problems are multiplied and magnified.

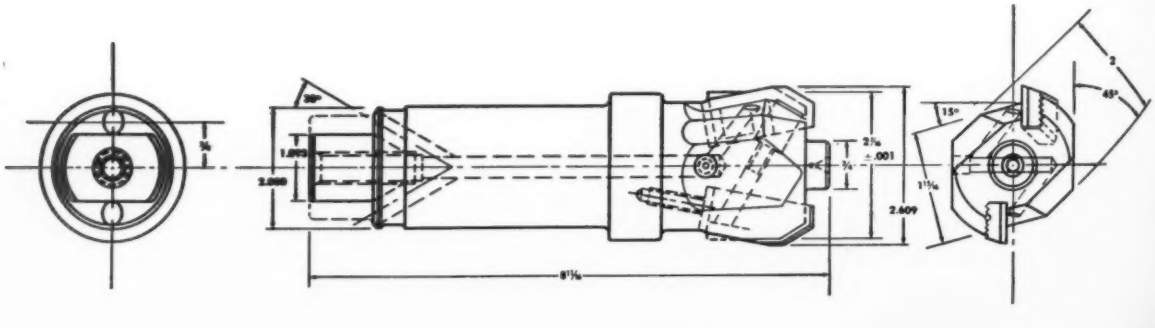
In the application of multiple diameter heads, the greatest single problem is that of chip mechanics. Hence, in design, blade angles and chip clearances are most important.

If boring into a blind hole, obviously all chips have to be pulled out the back. Where clearance for chip removal out the front of the hole exists, blade angles on the first diameter may effectively move chips in that direction.

While the primary purpose of rake angles is to direct the chip away from the cutting edge, other important factors influencing blade angle selection are horsepower available, cutting action, finish required, age of machine, and material specifications.

An example of how blade angle selection influences horsepower consumption can be illustrated by the use of negative radial and axial rake angles. By increasing these negative angles by only 5°, horsepower consumption will be increased by as much as 30%, depending on the type of material being machined. Obviously, a change of this nature should not be made if sufficient horsepower is not available on the particular machine to be used.

In boring steel with multiple diameter cutters, the best **general purpose** angles employed are 7° POSITIVE AXIAL and 7° NEGATIVE



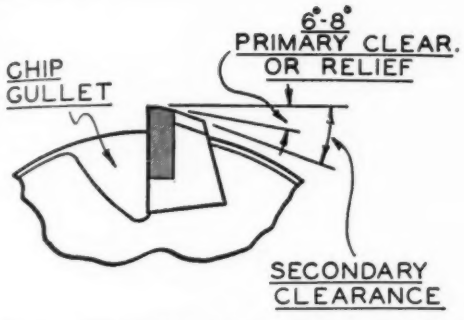


Fig. 2. Blade geometry as seen looking at working end of tool.

RADIAL (Fig. 1). Generally, this combination provides a smoother finish, more efficient cutting action, requires less horsepower, and activates the chip back away from the cutting edge.

The 7 & 7 combination actually creates a high shearing action on the chip. Occasionally, the requirements of a specific job will make it necessary to employ a different combination of angles and, if so, it should be remembered that:

(a) At high surface speeds (280 to 400) the degree of positive rake — radial or axial — should decrease while negative rake angles increase.

(b) At high depth of cut (¼" to ½") positive rakes should increase while negative rakes decrease.

Equally important to remember is the specific nature of the cut on all surfaces. If an interrupted cut, negative rake angles should definitely be used.

The number of blades for each operation are decided arbitrarily by the speeds and feeds necessary to meet production requirements and cycle time.

The best "tool life" chip loads are a minimum of 0.005" and a maximum of 0.020" per blade. Working within this range, total number of blades per diameter of operation are determined by the following simple formula:

$$\frac{\text{Feed (ipm)}}{\text{RPM} \times \text{Chip Load per Tooth}} = \text{No. of blades}$$

A hypothetical computation might be a boring problem calling for the following:

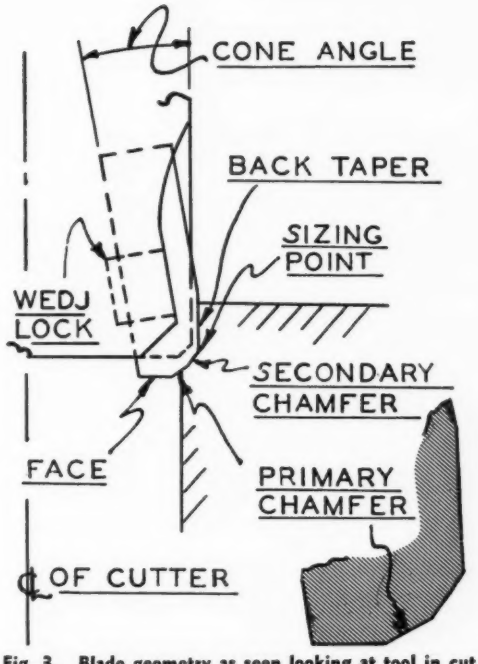


Fig. 3. Blade geometry as seen looking at tool in cut through vertical cross-section of workpiece.

5.75" feed
0.005" chip load/tooth
5" bore diameter
250 sfpm

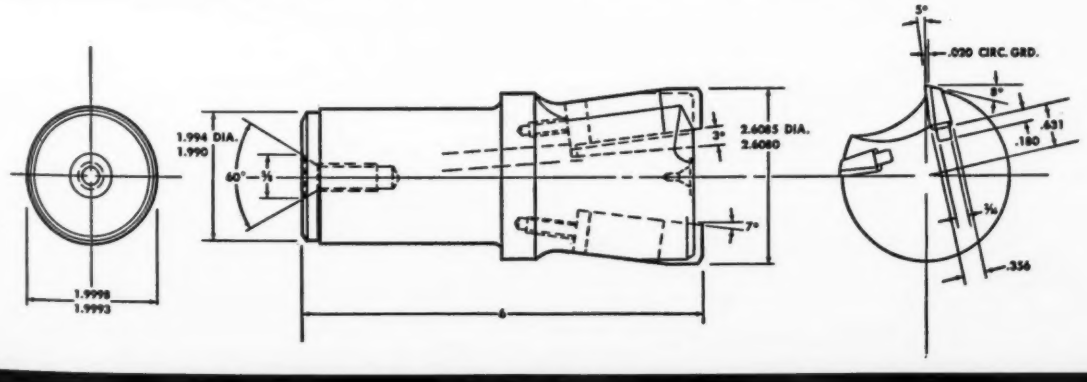
Computation:

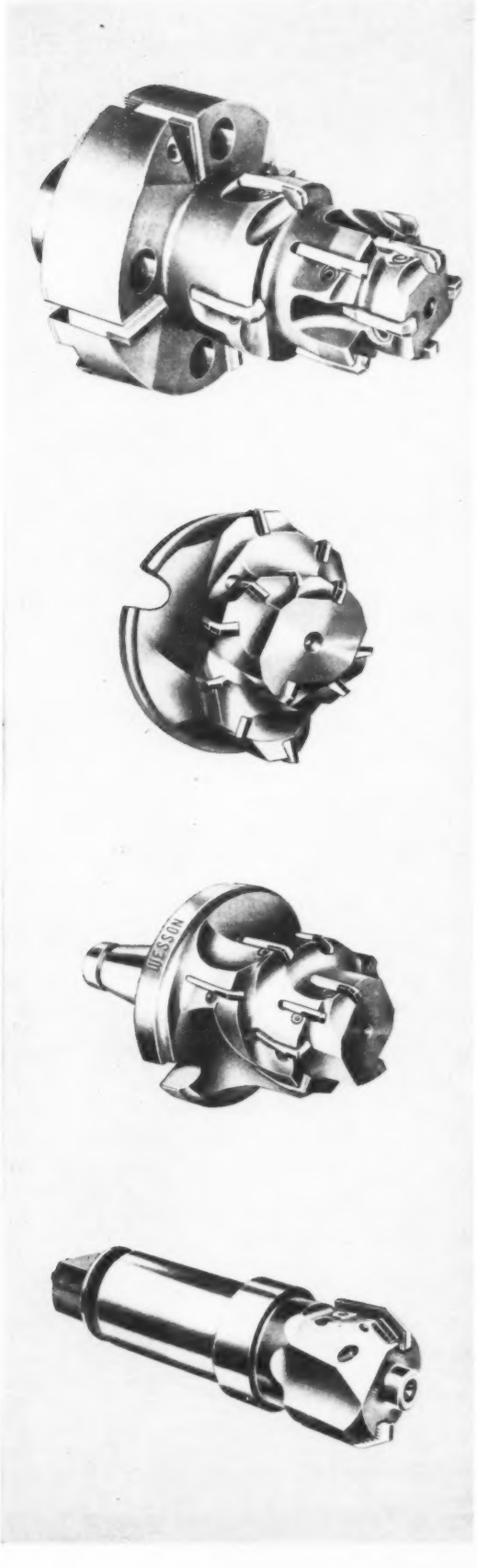
$$\frac{\text{5.75" Feed}}{\text{195 RPM} \times \text{.005 Chip Load}} = \text{6 blades}$$

Where rigidity of the machine is extreme, the chip load may be increased effectively by as much as 0.010" on both the minimum and maximum limits. Where the machine lacks rigidity, the range indicated will have to be reduced.

Occasionally, job requirements may call for an excessive number of blades. In the interest of overall body strength, blade thickness must be reduced. This will affect chip load limits.

By the same token, when body strength would be seriously impaired by too many blades, the designer should incorporate fewer blades even though recommended chip load limits may have to be increased. This is necessary to safeguard against complete cutter destruction in application.





Combining a number of cutting operations into such tools as these multi-diameter boring heads can often realize substantial savings for the user. Savings accrue through 1) elimination of machines and/or work stations, 2) elimination of handling work from one operation to another now done in the same setup, 3) better control of concentricity of multiple diameters and depth relationships, and 4) great reduction in relative machine downtime for tool setup and change.

Blade Design

In addition to axial and radial rake angles, primary and secondary clearance angles, circular ground land, chamfer angles, base angle, and back taper must also be carefully selected and controlled.

The clearance angles used will be directly affected by the feed, depth of cut, rigidity of the part and setup, and the hardness and type of material.

The primary clearance angle (relief), affected by the above factors, is also influenced by the diameter of the workpiece. But, the most effective general purpose angles are 6° to 8° clearance on the carbide. These should be cleared to a cylindrical land (Fig. 2).

In specifying primary clearance angles, it must be remembered that excessive clearance will cause chipping of the cutting edge and too little clearance will cause rubbing and chatter.

Cylindrical lands are DEFINITELY recommended for all boring operations on steel and cast iron. They contribute to finer finish and help to hold size. Width of lands will vary from 0.007″ to 0.020″. Generally, a land from 0.008″ to 0.012″ will handle most cast iron and steel jobs.

Actually, even a relatively small land will remain after grinding since it is extremely difficult — and highly impractical — to sharpen the blade to a keen edge. If tried, blades will wear rapidly and lose size.

Practically all cutting by a boring cutter blade is done on the intersect line — the point at which the chamfer and leading edge of the land meet (Fig. 3). Practitioners also refer to this as the sizing point.

The chamfer angles employed on boring cutter blades may range from 0° to 45° off the face of the blade, and the length of chamfer will vary with the depth of cut.

Always make the chamfer at least $\frac{1}{16}$″ longer than the maximum depth of cut. In this way, any possibility of cutting on the blade face is eliminated. See Figure 4.

A secondary chamfer may be used to give a scraping action that helps to size and smooth the walls of the bore. The presence of a secondary chamfer on many operations also con-

tributes to more efficient cutting.

The secondary chamfer or lead usually consists of 1° to 10° depending on the depth of cut. Actually, this chamfer is an extension of the prime chamfer and on cuts requiring large stock removal, it aids in "easing" the cutter into the cut and stabilizes the cutting action.

Unless the operation specifically requires the use of a secondary chamfer, it is not recommended generally since its use runs up grinding costs considerably.

Bear in mind that the uniformity in grinding blade chamfers must be held to 0.0005″ to eliminate any possibility of one or two blades performing all the work. If this happens, rate of tool wear increases rapidly and the hole will lose size.

At the same time, a "whiplash" will be created that results in an "out of round" condition. It can be seen therefore that the addition of a secondary chamfer should be carefully considered.

When finish is a requirement, a fair degree of finish can be effected by designing the blades in the body with the cutting edge "slightly" ahead of the centerline of the workpiece.

If a high degree of finish is essential, go to a radius on the intersect line. As a general practice, a radius is not recommended for multiple diameter boring heads. But where it is essential, it must be remembered that the finish produced is influenced by both the amount of radius and lead angle.

For example, a radius of 0.005″ and a lead of 0.0005″ will produce a 3 micro-inch finish. On the other hand, a radius of 0.100″ and a lead of 0.008″ will produce a finish of approximately 47.8 micro-inches. Hence, as radius and lead increase, finish decreases; as radius and lead decrease, finish increases.

Of equal importance is the back taper to be employed on the blade. On most jobs, the rule of back taper of from 0.001″ to 0.002″ per inch of blade length will prove adequate. However, on heavy roughing cuts, this may be increased. The same applies to abrasive materials. In finishing, 0.0005″ taper per inch of blade length is recommended.

On a new machine, or a machine with a good degree of accuracy, start with a back taper of 0.001″. However, if there is possibility of misalignment, back taper should be equal to the greatest possible misalignment.

To illustrate this, assume the spindle is out "a tenth" and the overall length of spindle to the cutting edge is 10″. The spindle error of $\frac{1}{10}$th is multiplied at the cutter to 0.002″.

Where a relatively wide land is used, a maximum back taper should be incorporated to insure adequate clearance. For example, where the land is $\frac{1}{16}$″, back taper of from 0.003″ to 0.005″ per inch of blade length is recommended.

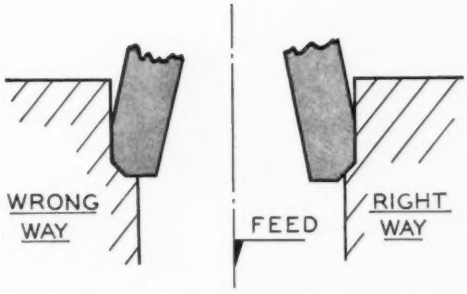


Fig. 4. Length of chamfer relative to depth of cut. Avoid small chamfers where irregular stock removal may result in cutting on blade face, adding to maintenance cost.

Blade Location — Placement

ALWAYS place blades so that each is directly opposed by another at 180°. When more than two blades are placed on any one diameter, STAGGER THEM IN PAIRS as shown in Figure 5. One set can be 2° ahead of centerline while a second set can be 3° behind centerline.

The net result is, each blade "cuts its own path" and results in a finer finish by elimination of chatter and excellent cutting efficiency.

At the same time, each set of blades should be staggered with blades on succeeding larger diameters to create a "through passage for chips to travel up the side of the cutter through the chip gullets of each blade above (Fig. 6).

From a maintenance standpoint, the angle at which the blade is seated in the cutter body is extremely important. ALWAYS design insert slots on as large a cone (or base) angle as

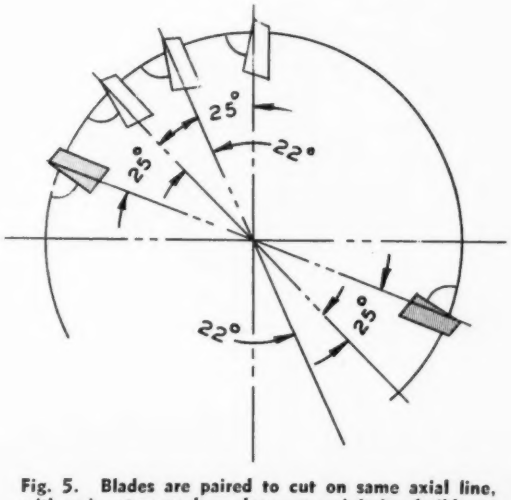


Fig. 5. Blades are paired to cut on same axial line, with pairs staggered as shown to minimize build-ups of harmonic vibrations.

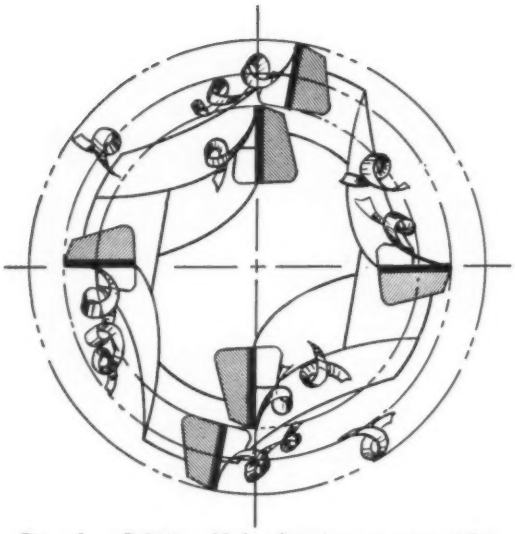


Fig. 6. Relative blade location on successive diameters for free chip flow. Chips flowing from blades on smaller diameters utilize "gullets" of blades on next larger diameters. Note size of gullets.

possible consistent with body strength.

A large base angle will result in considerable savings, not only in grinding time, but in the total life of each blade. The MINIMUM angle recommended for either solid carbide blades or carbide tipped blades is 5°. If a smaller angle is ABSOLUTELY required, go to a tipped serrated blade.

Fig. 7. Cone (base) angle effect on grinding. View exaggerated for clarity. Strive for large cone angles to minimize regrinding.

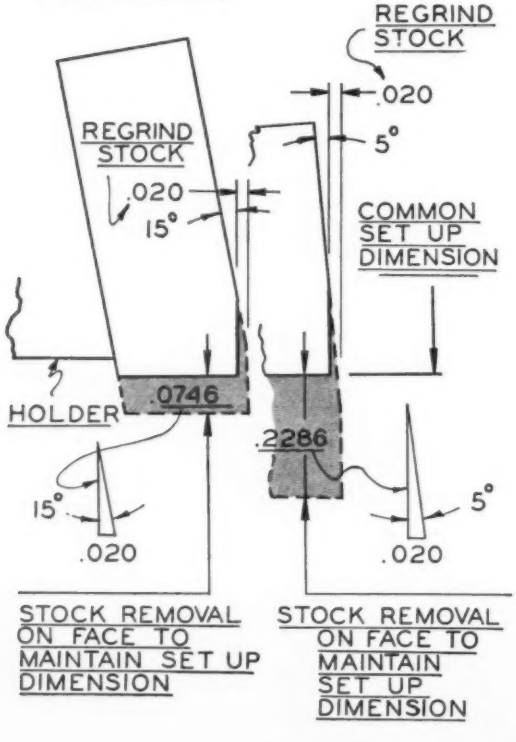


Figure 7 illustrates the effect of the cone angle on regrind economy. If it is established that 0.020" need be removed from the OD, during regrind, then simple trigonometry will show that, when the tool is moved out at 15°, less stock will have to be removed from the face to maintain the depth set-up dimension.

Strive for a cone angle of 12° to 15° for the greatest economy and efficiency.

Blade Type — Locking

Use solid carbide blades wherever possible. A feature or advantage of the solid blade in application is the superior production ability of the solid carbide with inherently greater impact strength and rigidity. While slightly higher initially in cost as compared to carbide tipped blades, it provides many more regrinds thereby reducing the blade cost per piece.

Blade locking can be achieved in one of several ways — each having its advantages and disadvantages. The choice of locking methods in many cases will be determined by a number of operational factors.

Two basic methods are: 1) a mechanical lock on the face of the blade, or 2) a wedge on the face or beneath the blade. Selection will be influenced by amount of chip gullet required, ease of adjustment, amount of rigidity required, the number of blades used, and the nature of the cut — interrupted or continuous.

The mechanical lock employed on the face of the blade will prove a limiting factor where "large" chip gullets are required; however, it provides the easiest and fastest locking.

Superior rigidity of locking and maximum chip gullets required can be achieved, using the wedge principle. Where an excessive number of blades is required, dovetail locking will prove the best method with the wedge beneath the blade — the Rigidcut principle.

A final important design factor that will affect maintenance and production costs is the provision made for either spindle or cutter adjustment for depth.

Where adjustable spindles are provided, considerable time savings in tool change, grinding and setup will be affected. Where spindle will be non-adjustable, incorporate an adjustable cutter adaptor. If used, individual blade out-adjustment will only be required every fourth or fifth regrind on the average. end

Mr. Gable's discussion will be followed, in the March issue, with a comprehensive Tool Trouble Analysis Chart. While related directly to multi-diameter boring heads, much of the information will apply to boring tools in general and even to other tool families.

CARBIDE METALLURGY SIMPLIFIED

by E. V. Anderlite
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THE FACT THAT MORE THAN 150 designations of carbide grades are in use by the various producers leads the average user to the belief that even the basic elements of carbide metallurgy are beyond his scope. However, the apparent complexity can be resolved, and an understanding of basic structures can be readily gained. This will help the tool technician or the engineer at the drawing board to organize his carbide thinking. Then he can more effectively use carbides and solve more of the problems of tool application.

Almost all the carbides in use can be classified into three groups: Cast iron and non-ferrous cutting grades; steel cutting grades; and wear or die application grades. Two of these (the non-ferrous and wear grades) are quite similar in composition and structure and actually consist of mixes of only two materials. These are tungsten carbide, which is the superhard material that does the cutting job, and metallic cobalt which serves as a binder to cement or bond the carbide particles together. The only exception to this simple cobalt and tungsten carbide composition is where some manufacturers add a minute percentage of tantalum or titanium carbide to assist them in their manufacturing processes.

Referring to the chart (Fig. 1), it will be seen that the only difference in the non-ferrous group is that the percentage of cobalt is steadily increased from grade to grade. As the cobalt percentage goes up, note from the chart that the strength or the toughness of the material increases. However, the hardness declines. Any such grade then represents a compromise between toughness and hardness and the best compromise for a particular job can be selected from the producer's grade recommendations.

The grain size of the tungsten carbide in the mix also has some influence on the properties of the material. A careful manufacturer controls grain size to the optimum in order to get the best machining ability in the tool.

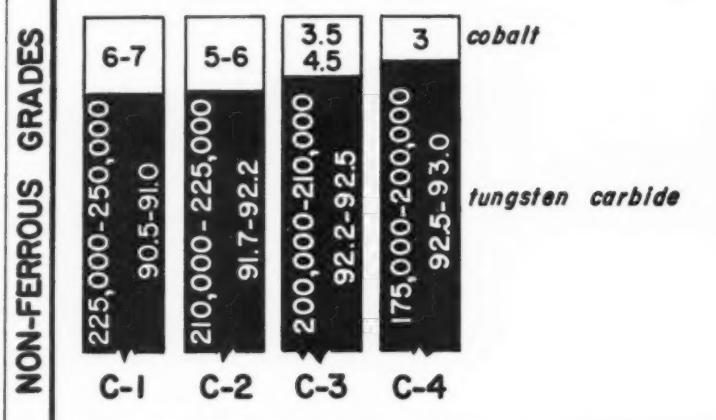
The basic non-ferrous and die grade compositions shown in the chart have been in use for the past 10 to 15 years or longer. Since there is little latitude in composition of the non-ferrous cutting grades, the variations in performance among the brands are usually a function of the manufacturing technique. Also, the non-ferrous group of carbide is quite simple to manufacture and since it has been standardized through practice for a long time, differences in performances between the brands are generally relatively slight and will not, as a rule, give rise to serious difficulty or tool failure on the job. A good many of the problems experienced with non-ferrous cutting materials originate in the work material or setup.

Carbide technicians are frequently called out on trouble jobs where failure or poor performance are attributed to failure or deficiencies in the carbide. A study of case histories among several companies reveals that less than 10% of such difficulties originate in the carbide.

So it is a good general rule where trouble is experienced with the non-ferrous grades to check the setup, tool geometry, speeds and feeds, and the work material first. Your carbide manufacturer can supply you with sound

COMPOSITION OF CARBIDES

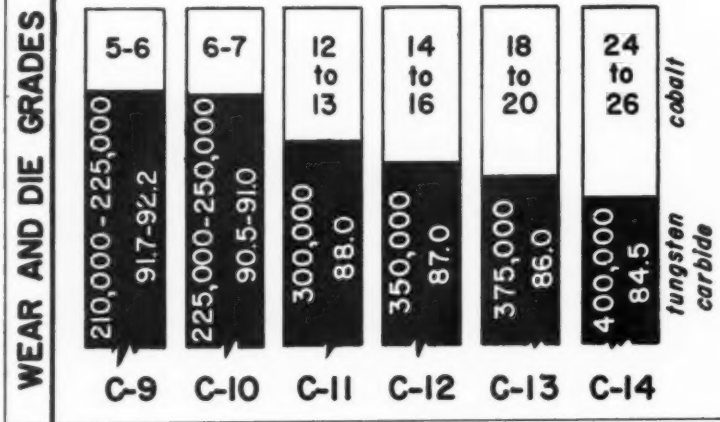
Shown below are the compositions of cemented carbides, classified according to the Carbide Industry "C" numbers. The percentage of each material used varies from manufacturer to manufacturer, generally within the narrow ranges shown. Differences in performance result from variations in processing methods and the amount of care used to eliminate impurities, control grain size, etc. in manufacture. For purposes of illustration the graphs are not to scale. Figures in thousands are the range of transverse rupture strength. Figures with decimals are Rockwell "A" hardness.



CAST IRON AND NON-FERROUS GRADES

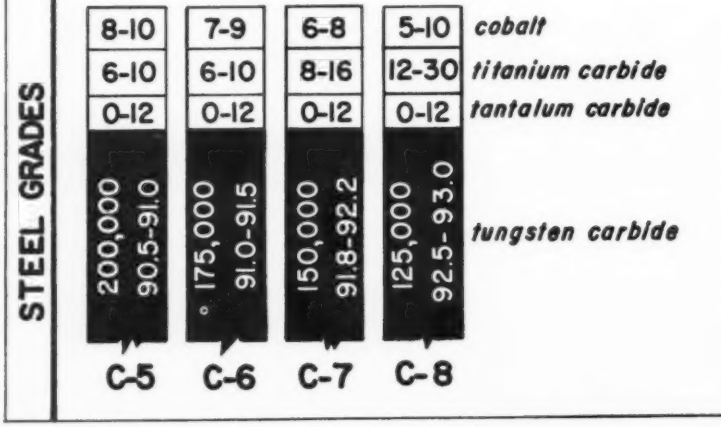
Only two basic materials, cobalt and tungsten carbide, are used to make non-ferrous carbide grades. Over the years the compositions have been standardized, with only slight modifications by the occasional addition of tantalum or titanium carbides in minute quantity.

Note that the hardness (and the wear resistance) increases as the cobalt content decreases; the toughness, however, goes up with the percentage of cobalt.



STEEL GRADES

The influence of cobalt content on hardness and strength is less significant in the steel grades than in other carbide grades. Note that the variation in cobalt between grades is not progressive. Desired physical properties are gained mostly through the addition of titanium and tantalum carbides. Since there are more variables in composition—and in processing — the variation in performance between the various brands may be extreme. The understanding of these variables is not as complete as in other carbides. Therefore the practical approach of testing different carbides for the particular application is generally most resultful.



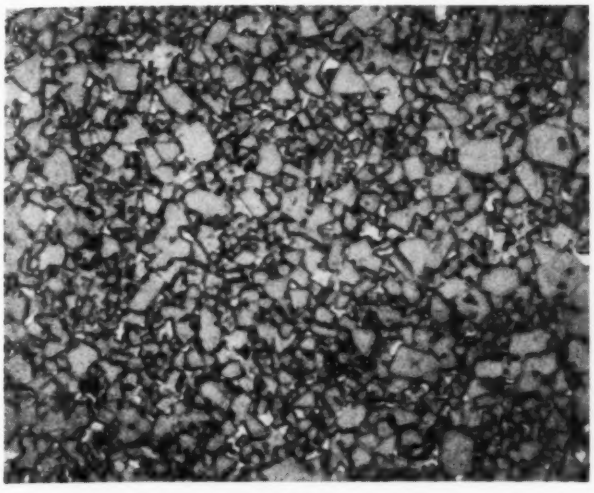
WEAR AND DIE GRADES

The wear and die grades or carbide are continuations from the non-ferrous grades, ascending the cobalt scale. Note that C-9 and C-10 actually overlap C-2 and C-1 and are frequently identical in composition and properties. As increasing toughness is needed to handle impact applications, more cobalt is added . . . up to grade C-14 which ranges as high as 26% cobalt. This is the maximum cobalt which present manufacturing techniques permit. The addition of cobalt is made at a sacrifice of hardness, which usually means a sacrifice of wear resistance.

FIGURE 1

MICRO-STRUCTURES OF CARBIDE

Two samples of tungsten carbide from different manufacturers may have identical chemical compositions, but perform quite differently on the job. The difference is due to the physical properties imparted by variations in manufacturing processes, such as the amount of control exercised over impurities, grain size and so on. Illustrated are typical grain structures of carbides for various uses. The photomicrographs were taken at 1500 diameters.

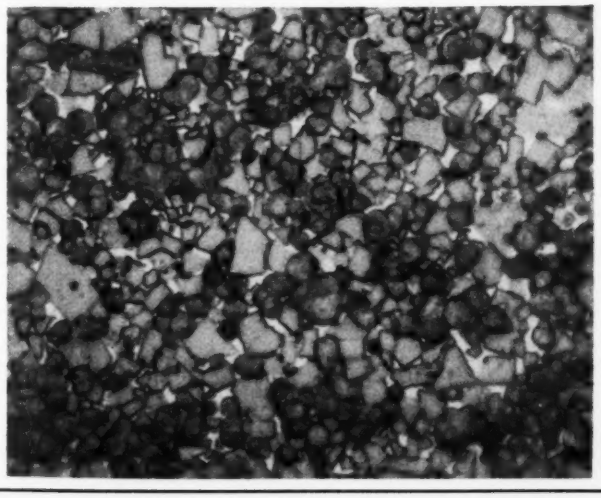


CAST IRON GRADE

The light colored areas are cobalt. The grey areas are tungsten carbide grains. Compared to the other carbides it has a fine grain structure, which assists in increasing wear resistance. The grade shown is a C-2.

DIE GRADE

In this carbide note the increase in the white areas which indicate an increased cobalt content. Since the cobalt acts as a binder, the strength is increased. The grade shown is C-12.



STEEL GRADE

The tungsten carbide shown is a C-5 steel-cutting grade. The grain size is larger than the cast iron grade. The grey angular grains are tungsten carbide; the remaining, more rounded grains are tantalum and titanium carbide.

FIGURE 2

data on these functions which may save you much time and grief on trouble jobs. The various manufacturers' grade recommendation charts can be used with considerable confidence when applying this carbide group.

Here is a word of caution: Carbide technicians find that many carbide users attempt to check hardness of carbide themselves, particularly where excessive tool wear occurs. However, if you refer to the chart, you will see that there is a difference of only one point in the Rockwell "A" hardness between the roughing and finishing grades. Without the specialized equipment which is only found in the carbide producers' plants, decidedly erroneous conclusions can be reached. If there appears to be sound reason for questioning the carbide hardness, it is better for the user to turn a sample over to the manufacturer for determination of this physical property.

A study of the composition graph shows that the die and wear grades are actually a continuation of the non-ferrous cutting grades. The differences are only in the increased percentage of cobalt. Actually, C-2 and C-1 overlap C-9 and C-10 and can be used interchangeably. This is convenient in simple wear applications because standard cutting tool tips can be applied.

The die grades include those for wire drawing and other applications where the carbide is subjected to a minimum of shock and cover the range up to the extreme shock applications, such as cold heading dies. For toughness, the percentage of cobalt is increased with the amount of shock expected. The cobalt percentage may range as high as 26%, which is the highest percentage that present manufacturing techniques will allow.

So long as manufacturing facilities are adequate and great care is used to prevent porosity and contamination in manufacture, the carbide producer generally experiences less difficulty in holding consistent quality standards on these grades than on any other. Consequently, case histories show that most cases of failure of this group of carbides are due to die design and specification of the wrong grade for the job.

It is suggested that the carbide producer be supplied with complete data on the job when the carbide is ordered. He can make recommendations which will help to avoid a great many of the troubles experienced. In fact, the carbide user should always feel free to consult the carbide manufacturer, who is always interested in seeing that the job turns out successfully.

Of the three carbide groups, the steel cutting grades are the most complex. (See chart.) The variations in binder, alloy and manufacturing techniques introduce many variables that do not exist in the other two groups. And it must be honestly said that the steel fabricating grades are still to some extent in the stage of trial and error in application.

Grade recommendation charts issued by the various manufacturers, although useful, **are only recommendations,** and should not be used as the final word. There are significant differences in composition and processing methods, raw materials, etc. used in the steel grades. Therefore, although they are in the same classification it is only common sense to realize that the brands are not equivalent in performance although they may fall under the same "C" number in classification charts.

When comparing different carbide manufacturers' carbides, the carbide user should try to run actual cutting tests under identical conditions if possible.

In the future development of carbides, you can expect the most startling advances to occur in the steel cutting group. The development of new steel cutting grades is frequently too much a trial and error process — an art, rather than a science. When this situation is widely corrected, you can look for general improvement in performance from these grades.

A few manufacturers are willing to develop special grades for applications where the volume of usage will justify the cost. Particularly in cases where a modest gain in tool performance will result in a considerable cost saving, such as an application where downtime is exceedingly expensive, some thought should be given to development of a special grade.

In summary, to eliminate some of the mystery of carbide understanding, you should realize:

1. The grades that are most similar among most manufacturers and that can be expected to give the user the least difficulty are the non-ferrous cutting grades and die and wear grades.
2. The grades that can be expected to show the most variation from brand to brand are the steel grades.
3. You should realize that an honest evaluation of case histories on troubles in non-ferrous, die and wear grades shows that less than 10% originate with the material.
4. There should be no hesitation in consulting the carbide manufacturer, even on minor problems. Many a telephone inquiry to a carbide supplier has resulted in substantial savings and elimination of production headaches.

end

A SCIENTIFIC MANAGEMENT ARTICLE

METHODS-TIME MEASUREMENT
As Applied to Punch-Press Operations

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METHODS-TIME MEASUREMENT (M.T.M.) has various applications in punch press operations. Two of the more important are its use in quickly setting up Standard Data and its use in pre-evaluation of engineering tools, layouts, and methods. First, let's take a little closer look at M.T.M. and Standard Data.

M.T.M. is nothing more than a defined grouping of elementary motions with the corresponding standard time value for performing these motions. This being the case, synthesizing various motions into a pattern and adding their time values will give the total time required for performing that pattern at normal effort. It is this attribute of M.T.M. that allows Standard Data to be developed easily and rapidly.

As you know, Standard Data is the grouping and classifying of elements of work which occur within a given area. Standards for performing a given job within this area can be arrived at by selecting the elements of work from Standard Data charts and adding their values to obtain a total. This is why Standard Data can rapidly set standards. This rapidity makes it extremely valuable to job shop operations such as ours.

Standard Data must be simple for best results. To be simple means as few variables as possible. To eliminate variables requires a thorough standardization of the workplace. This is extremely important, for not only does it simplify Standard Data, but provides the same impartial working conditions for each worker. Standards set under these conditions are much more consistent and acceptable.

Now let's see how M.T.M. can be used to rapidly set up Standard Data. The following shows element breakdown:

- Repetitive Cycle
  - Automatic
  - Hand Eject
- Position
  - Initial Point
  - Move
  - Seat
  - Release
- Machine Time
- Miscellaneous
  - Inspection
  - Wipe Die
  - Oil Die
  - Blow Chips

The primary consideration of M.T.M. is the motion involved. Keeping this in mind, what motions are necessary to work a punch press? Which ones are repeated time after time regardless of what type of part is held in the hand? The first thing to look for in a typical Standard Data analysis is the repetitive cycle. This repetitive cycle will likely consist of two parts. First, the motion patterns where the part is automatically ejected from the press by air or mechanical means; and, secondly, the motion patterns where the part is removed by hand.

For example, let's examine a typical automatic ejection cycle. One of the motion patterns which is used in this case and one that would be repeated regardless of the shape of the part would be as follows: Move the part to the die with the right hand, move the right

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The main text of this article was originally delivered as a talk to the Providence Chapter of the Society for the Advancement of Management, at Brown University, Providence, R. I.

WHAT IS M.T.M.?

FOR MANY YEARS Management has felt the need for a procedure for establishing production standards that would eliminate the element of judgment on the part of the methods engineer. When a time study is made under the conventional time-study procedure, it is necessary for the observer to form a judgment of how the performance of the operator compares with the average or normal performance level. Regardless of the fact that such judgments can be made quite accurately by the experienced observer, because the intangible element of judgment is involved it is difficult to prove that a correct determination has been made.

There is often a tendency on the part of the worker to question the accuracy of standards determined in this manner, particularly if industrial relations are strained. And management has no way of proving the rightness of its production requirements except by studying and restudying the job until an overwhelming mass of evidence has been gathered.

This is costly and time consuming. Therefore, a procedure that eliminates the element of judgment will not only be more acceptable to labor, but it will be more economical to apply.

The methods-time measurement (M.T.M.) procedure eliminates the necessity for judging the performance level at which an operator works while being observed. The procedure is simply one of determining the motions required to perform the operation and then of assigning predetermined time standards to each limiting motion. The sum of the motion times gives the production standard for the job. True, a certain amount of judgment is required to determine what motions are necessary to perform the operation, but when the observer has an intimate knowledge of the work he is studying, this poses no particular problem. There is no judgment required insofar as the element of time is concerned, for the time standards used in the methods-time measurement have been predetermined as the result of lengthy research and investigation and are always the same for each set of motions.

The methods-time measurement procedure was originally developed as a means of methods improvement, and it is very effective when used for this purpose. Because of the constant strain on industrial relations which is caused by the element of judgment in the work measurement process, however, management is likely to find that the improvement in industrial relations that is brought about by the use of the methods-time measurement procedure is just as valuable as the improvement in methods which inevitably follows its application.

Methods-time measurement is a useful tool for helping to engineer a method before beginning production. The procedure is a logical development that arises from the long-recognized need of being able to treat method and time simultaneously instead of separately.

Other uses of M.T.M. include:

1. Improving existing methods.
2. Establishing time standards.
3. Developing time formulas or standard data.
4. Estimating.
5. Guiding product design.
6. Developing effective tool designs.
7. Selecting effective equipment.
8. Training supervisors to become highly methods conscious.
9. Settling grievances.
10. Research — particularly in connection with methods, learning time, and performance rating.

What Is a T.M.U.?

One of the reasons why M.T.M. works so well is that it is based on a very fine breakdown of motions that are measured very accurately. Since the motions are so fast, it would be very hard to use any normal unit of time to measure them. Even a second is too big a unit. For this reason, M.T.M. works with a time measuring unit (TMU) which is one one-hundred thousandth of an hour (.00001 hr). This unit is perfect for M.T.M. because many of the motions take less than 2 TMU's. There are 27.8 TMU's in one second. Special stop watches indicating in TMU's are available for M.T.M. work.

All of the standard motion time values found in M.T.M. data charts and used in M.T.M. studies are given in TMU's. In setting a time standard for a job, all the TMU's are added up and then changed back to more conventional units of time — seconds, minutes, or hours.

SOURCE: "Methods-Time Measurement", by Harold N. Maynard, G. J. Stegemerten, and John L. Schwab; McGraw-Hill Book Co., 1948.

How Is M.T.M. Applied to Increase Production?

The two principal applications of this method with which the most work has been done at Wallace Barnes are in tool design and inspection. In both operations, hand-positioning of the work represents a large part of the total time-cycle per piece.

Positioning is the basic element employed to:

- Align the axes of both the part and the tool (or fixture) along the axis of travel.
- Orient the part around the axis of travel.
- Engage the part in the tool or fixture.

Positioning is mostly a **mental** operation, and mental fatigue is a much more taxing kind than physical, and much harder to recover from.

The greater the share of the total TMU's in the piece-cycle which are represented by "positioning", the greater is the scope for methods improvement by redesign of the tooling or a modification of the inspection procedure or fixtures.

Most punch press operations have a fairly short time-cycle per piece. With production running at the rate of 500 to 1000 pcs/hr (representing total TMU's per piece-cycle of 200 and 100, respectively), a saving of, say, 17% of the TMU's per cycle by a tool change or an inspection-fixture change that simplifies and reduces the positioning element represents a considerable saving and makes possible a considerable increase in the production to be expected.

The saving per cycle multiplied by the expected total production run yields the margin whose money equivalent is the amount available for spending on new tooling or provisions for automatic positioning.

Using only conventional time-study methods, you cannot determine how a tool will work until you make and run it. M.T.M. allows pre-evaluation from a sketch of the layout only.

hand clear of the die and guard, and trip the foot treadle to activate the press. Knowing these three motions and the distance through which they are performed, it is very easy to arrive at their single or combined time values by the application of M.T.M.

The same process would follow for repetitive cycles in hand ejection of the part. Again, the more standard the workplace and tooling is, fewer variable cycles will be necessary and a larger coverage can be obtained. Look at the time saved. Instead of having to time study a number of cycles and obtain average times for each cycle, the M.T.M. pattern can be written and the standard time arrived at in a matter of minutes.

Once we have covered the repetitive cycle of getting the part to the die and removing it from the die, we must look at how it actually fits and is put into the die cavity. This comprises the second part of Standard Data and may be called Position.

Here we have a problem. Parts of all shapes and sizes go into tools of all types and descriptions. It is very difficult to design standard tools when their functions vary so. At first, it seems an unsurmountable problem to determine just how to arrive at the time necessary to position a part in a die cavity.

But with the help of M.T.M. and its attention to motion, we find that when the investigation of position is undertaken from a motion viewpoint, it boils down to four simple elements. First, M.T.M. defines tolerances and the allowed time for these tolerances at the initial point of engagement of the part and the die. Secondly, we have an allowance to move the part into the die cavity if required. Thirdly, there is a time value for seating the part if a light or heavy pressure is required. Fourth, we must let go of the part and there is an M.T.M. element and time for this motion.

Simply, we can arrive at the Positioning time value for putting the part into the die by any combination of the values for tolerance at the initial point of engagement, move into die cavity, seating of the part in the die, and the release of the part.

The third part of our Standard Data is comprised of machine time. This is merely a mechanical calculation of the time required to make one stroke of the ram plus an allowance in the case of dog type release for the number of engaging points. For example, a flywheel with one engaging point would make one revolution before engaging if the press were tripped just after the engaging point passed the dog. An allowance would have to be made here for an average of ½ turn, making the total machine time allowance of 1½ turns. If the flywheel had 4 engaging points, it would only have ⅛ turn allowance.

The last part of our Standard Data is made up of miscellaneous elements. These elements, while a minor part of the cycle, are necessary to the standard where they occur. They appear as frequency and are allowed for on the basis of occurring once every so many pieces. Their time values are again determined by the M.T.M. patterns required to perform them. Examples of these elements are: gathering more parts, discarding parts, inspect parts, oil

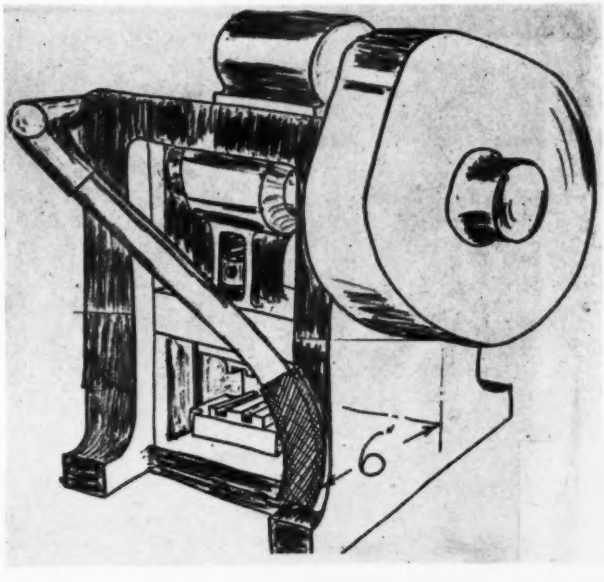


FIGURE 1

9.7	M6C	Move In
8.0	R6E	Reach Out
8.5	FM4"	Trip
26.2	T.M.U.	Total

GUARD 6" — 1000 pcs/hr

die, brush out chips, blow out chips, etc.

We ran into an interesting problem in developing an allowance for inspection. Due to the nature of our work which consists of high precision and high quality, a variety of gages are required to keep parts in tolerance during manufacturing procedure. These gages range from simple GO — NO GO plugs to complicated fixtures with dial indicators and built-in, slide-type GO — NO GO gages. They ranged from light, easily handled types to heavy immovable bench gages. The problem of how to quickly pre-determine how much time should be allowed for the operator to inspect parts was quite imposing. Just by looking at the array of gages puts you in the position of not being able to tell the trees from the forest.

Our salvation came when M.T.M. training said, "Forget the type of gage, but look at the motions involved". Sure enough, looking at the motions necessary to work the gages, gave us a table that fit on one 8½" x 11" sheet of paper, and would allow us to pick out the time for inspection on any type of gage no matter how complicated.

Following is a breakdown of the inspection elements:

Get Part
Part to Gage
  Gage to Part
Part on Gage
Clamp
  Turn
  Handle
  Pin
Method
  Eye
  GO — NO GO
  Slide
  Dial

In order to inspect a part, we have to get it in our hand. If the repetitive cycle were hand ejection, we would already have it. If the cycle were automatic ejection, we could get the part in four different ways. Time values were determined by M.T.M.

After the part is obtained, you can either move the part to the gage, or the gage to the part. Once the part is to the gage, the placing of the part on the gage can be assigned an M.T.M. value for this positioning element.

If necessary, the part can be held to the gage by clamping in some manner. Motionwise clamping is done either by a turning motion such as a wing nut, a pulling or pushing motion such as a lever, or an insertion such as putting in a pin.

All that remains now is the methods of actual inspection. This is done in four ways — by eye, by GO — NO GO gage, by slides fixed to gage, or by dial indicator. M.T.M. patterns again worked out the TMU's (time measuring unit = .00001 hr.) for inspection by each of these methods. This applies even to a simple visual inspection — for rough edges or burrs, as well as to the more complicated gaging operation.

To find the allowed time for inspection, simply select the elements that apply to the particular part. Add the get part, part to gage (or

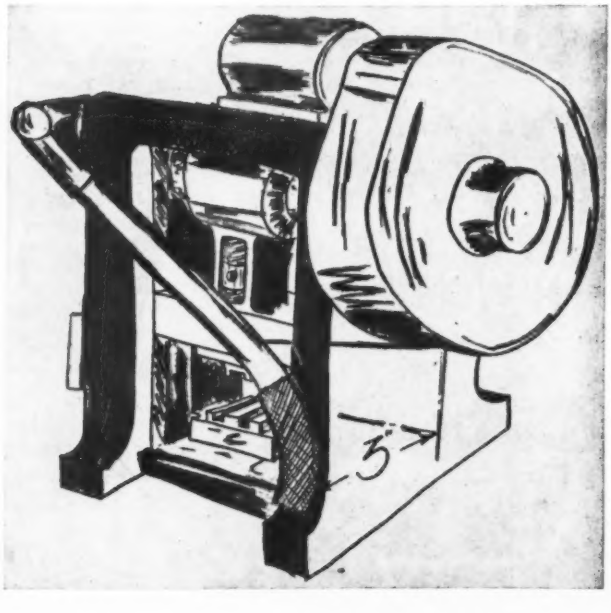


FIGURE 2

5.7	M3C	Move In
5.3	R3E	Reach Out
8.5	FM4"	Trip
19.5	T.M.U.	Total

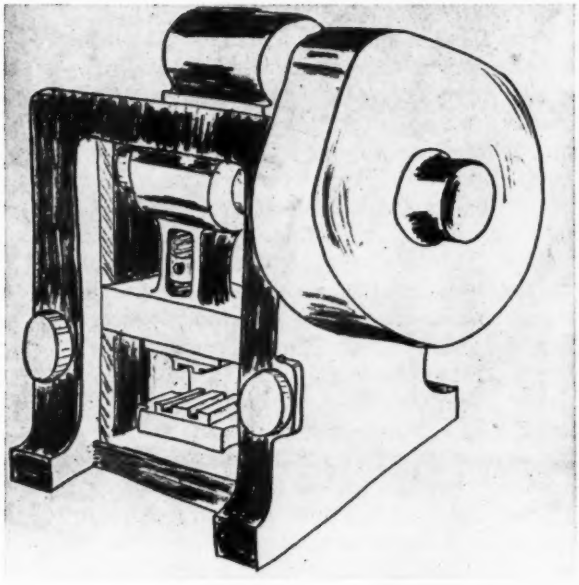
GUARD 6" — 1,000 pcs/hr

GUARD 3" — 7% Increase

FIGURE 3

9.7	M6C	Move In
7.0	R6A	Reach Out
1.7	M1A	Trip
18.4	T.M.U.	Total

GUARD 6" — 1,000 pcs/hr
GUARD 3" — 7% Increase
2 TRIPS 6" — 9% Increase



vice versa), part on gage, clamping, and method of inspection in any combination to get the total time.

Looking back over the parts to our Standard Data, we find that computing a standard is quite simple. Select the Repetitive Element, determine the Position values, obtain the Machine Time, add in the Miscellaneous Elements necessary, and add up to give a grand total. Finally, the production standard is determined by applying the necessary allowances.

M.T.M. does not stop in its value to Punch Press operations by the establishment of Standard Data. Even more important is the fact that M.T.M. provides a tangible and consistent measure of human motion. It is, in itself, Standard Data. This concept is extremely important, for now at last there is a way to evaluate a motion pattern. This evaluation means that we can now truly engineer a job by pre-determining which is the best motion pattern and just how much better it is.

To engineer, we must design with full knowledge of the results that are to be obtained. Engineering might be considered in two parts, to create and evaluate. Creating an idea is to design, but if there is no way to tangibly measure this design, we have not truly engineered. Neither have we truly engineered if we merely measure or evaluate an existing pattern. We must tangibly measure what we create in advance of the actual product before we can say that we truly engineered.

Here are a few examples of how M.T.M. can help engineer workplace layout and tool design. How a design helps or hinders an operator and by how much, should be carefully worked out in advance.

Let's take a small bench-type power press as shown in Figure 1. Here we see that the press is equipped with a swing guard that swings 6" out from the center of the die. This means that an operator must reach her hand out of the die 6" to be clear of the guard. For example, let's suppose a portion of the Standard Data pattern consists of a 6" move in to the die, a 6" reach out of the die, and a 4" foot motion to trip the press. The M.T.M. pattern for these three motions shows a total of 26.2 TMU. For the sake of example, let's assume that the standard on this operation is 1000 pcs/hr using the 6" swing guard.

Now let's see what would happen if we were to move the guard in so that it was only 3" from the center of the die as shown in Figure 2. This would reduce the move in to 3", the reach out to 3", and the foot trip would be the same. The element time is now reduced to 19.5 TMU. At the rate of 1000 pcs/hr, this would give us an increase of 7% in production standard.

Perhaps there was thought of using two hand trips instead of a foot pedal. For the sake of argument, let's assume that two hand trips could be placed so that only a 6" reach would be required. See Figure 3. The M.T.M. pattern shows us that if we still have a 6" move in, a 6" reach out, and a 1" move to trip the press, the element time would be 18.4 TMU and we would save a 9.9% at a rate of 1000 pcs/hr. The time for the foot to trip the press is eliminated, but note that it is possible to set hand trips far enough away so that no gain, in

fact, even a loss may be realized.

From these examples, you can see that from any position we choose to locate the hand trips or any other type of guard, the effect of the guard on the production standard can be determined before any money is spent on equipment. By knowing by what percent the standard can be increased or decreased, money can be easily applied to evaluate the worth of a change. The 9.0% saving in time for 30 people (40 hrs/wk), would amount to 5,400 hrs/yr. Knowing these figures, is it not easy to compute and decide on the proper program?

In the case of tool design, let us look at Figure 4. Here we see a tool as it appeared in production. From our standard data we found that we could expect a production standard for a skilled operator (before tool improvement) of 1,740 pcs. At this rate of production, the positioning element of putting the part on the die was 17% of the total standard. Positioning is additional to the move alone, and varies with the tolerance of the part.

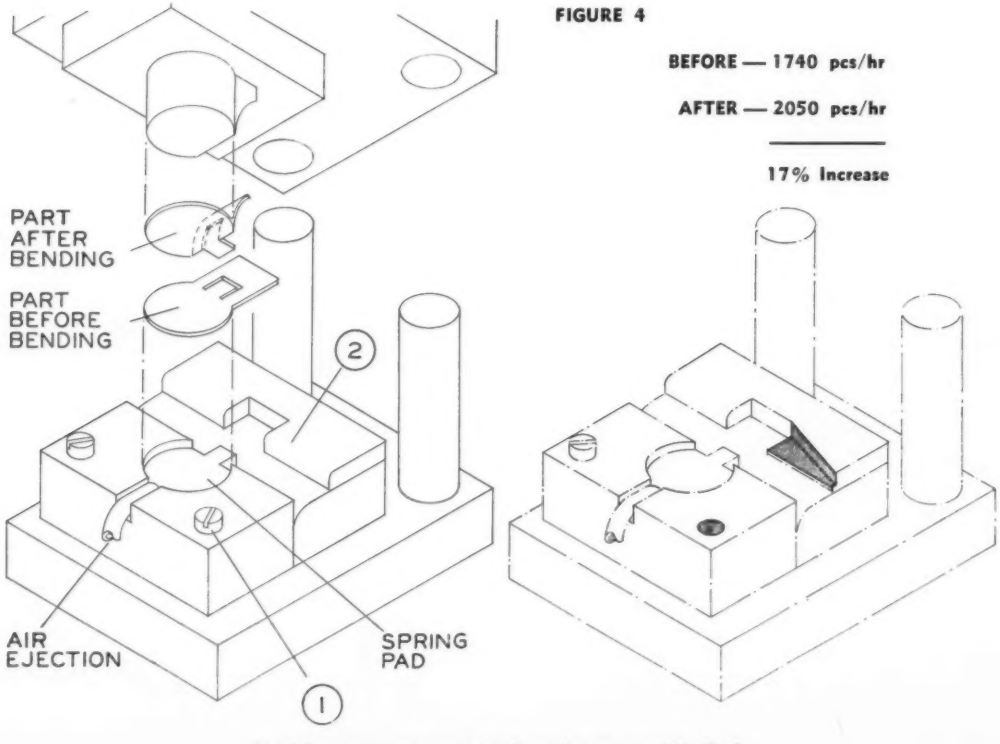
By a simple change of the tool — grinding down one corner (for right hand worker) and setting one screw flush — the part could be slipped into place more easily, and the tolerances of initial engagement were thereby opened to eliminate the positioning element. This is shown at the right. We could expect a production increase of 17% from this change in the tool.

Actually, this is closing the barn door after the horse has left. Should not the tool designer be trained to be aware of the handling problems and motion patterns necessary to work his tool? Much can be accomplished by building into the tool the easiest motion pattern. Standards will be higher, work easier, and fewer upsetting and time consuming changes would have to be made.

Entry is ordinarily a **minor** consideration to the tool maker. But entry is a **major** consideration in determining the production rate and getting maximum capacity out of a press. Relatively speaking, it is only recently that the tool designing function has become distinct from the tool making function. And, as yet there has been little training of tool designers in the basic principles of motion economy.

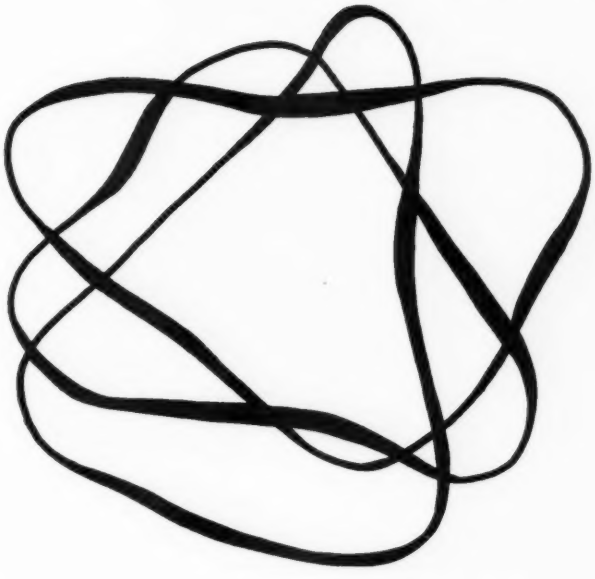
From these examples you can see the advantage of being able to pre-determine the results of a design or a proposed change. This systematic measurement of human motion has brought Industrial Engineering into the field of science.

FIGURE 4



Tool Improvement consists of setting screw (1) flush and relieving corner (2) as shown in view to the right.

TRACING WITHOUT TEMPLATES*



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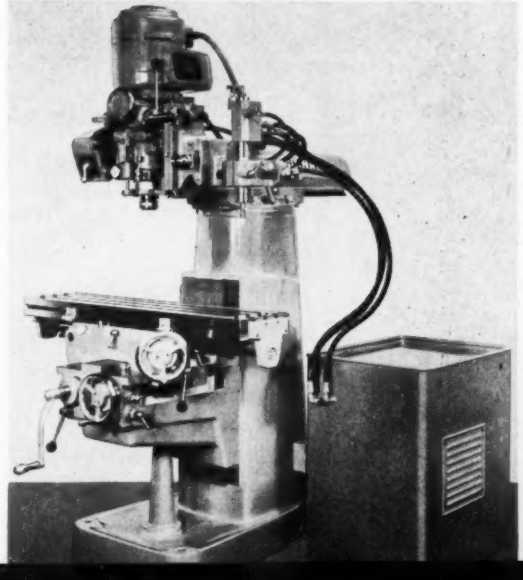
MACHINE TOOL MANUFACTURERS are constantly engaged in efforts to improve their machines—to improve metal removing ability, to improve ease of operation, to make operation more automatic, to improve quality of finish, and to decrease tolerances. One consequence has been a great increase in number of the types of machines now available.

One particular variety of machine that has inspired much interest in the industry are those generally referred to as tracing, profiling or contouring machines. Now being built by a large number of machine tool builders, their designs incorporate control systems of many types. To illustrate the variety found in tracer operated machines, as one manufacturer alone, Cincinnati builds a small die sinker equipped with depth tracing, Figure 1; a four-spindle profiler equipped with a 360° profiling tracer, Figure 2; a 30″ x 96″ Hydrotel unit equipped with three dimensional hydraulic tracing; and a gantry-type skin mill.

One of the major disadvantages in the use of conventional tracing machines is the necessity for making a template to be used as a master. On most tracing machines, the shape of the master is reproduced in the workpiece by means of a finger or stylus. For a number of years, the need has been clear for a machine that will reproduce a drawing without the necessity of making a template. We feel that in the Cincinnati Line Tracer System we have a very practical answer to this problem.

The Line Tracer combines electronic, hydraulic, and mechanical components into a system that can follow a line on a drawing. It represents the addition of electro-hydraulic control to a basic Hydrotel machine.

Fig. 1. This Contourmaster die sinker equipped for depth tracing is one of a growing number of tracer operated machines.



*Presented at the 20th Annual Machine Tool Electrification Forum, sponsored by the Westinghouse Electric Corporation.

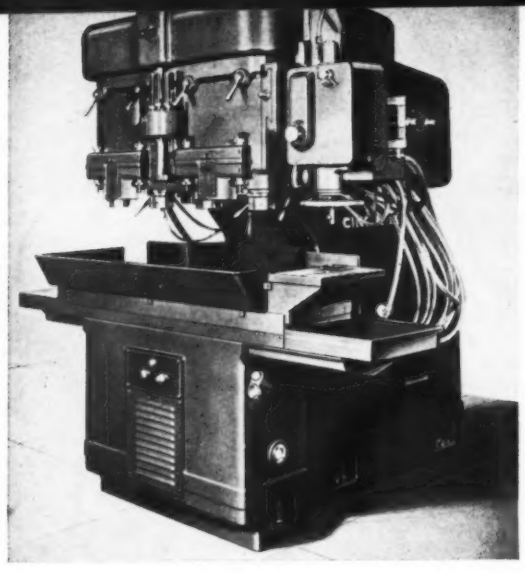


Fig. 2. This four-spindle profiler is equipped with a 360° hydraulic tracer.

Before approaching the operation of the entire system, let us first consider the basic Hydrotel machine itself. Once its operation is understood, the operation of the Line Tracer is easily followed. The 360° tracer control valve used on Cincinnati Hydrotels, Figure 3, and the tracer unit and the cylinders which control the two slides, Figure 4, are basic to the Hydrotel machine. Cylinder 1 controls the in-and-out movement of the cross slide on which the tracer unit is mounted, while cylinder 2 is the prime mover of the slide that contacts the master.

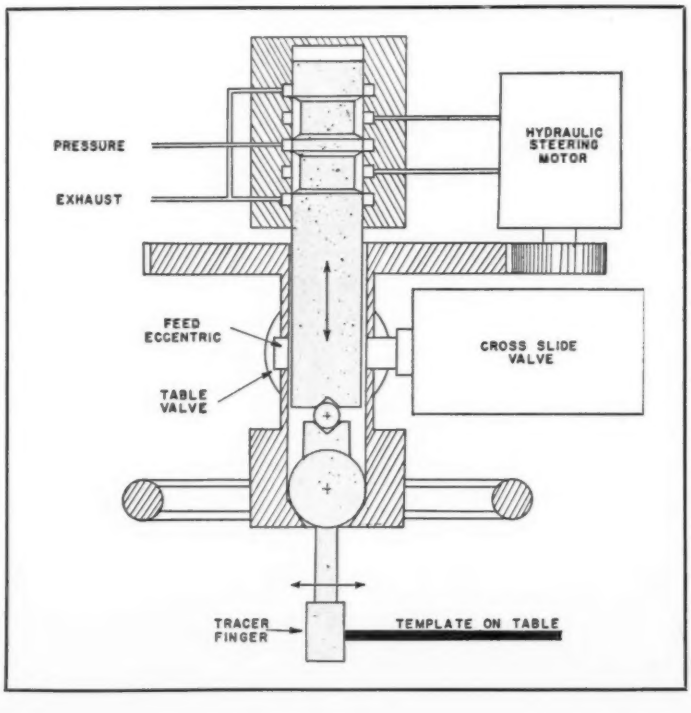
Valve 1 controls cylinder 1 and valve 2 controls cylinder 2. The feed eccentric controls the position of both valves 1 and 2. These valves are positioned in a complementary manner; they contact the feed eccentric at an angle of 90° and, therefore, their relative motion is 90° out of phase.

The ports and shoulders of the valves are made so that flow to each cylinder varies directly with the displacement of the valve from its center or neutral position. If these valves are made correctly, it can be shown that the velocity of the tracer with respect to the master will be constant, regardless of the direction of motion and directly proportional to the amount of eccentricity built into the feed eccentric.

The tracer valve, Figure 3, controls a "steering" hydraulic motor to which the body of the tracer and the feed eccentric are geared; the tracer ports are connected to the pressure source of the motor and tank. The tracer finger is made slightly eccentric to the axis of the tracer body. The finger eccentricity is pointed in the same direction as the feed eccentric and the direction of relative motion.

The tracer controls the direction of motion only. If the direction of motion is incorrect, the tracer finger will interfere with the master

Fig. 3. A schematic elevation of the 360° tracer control valve.



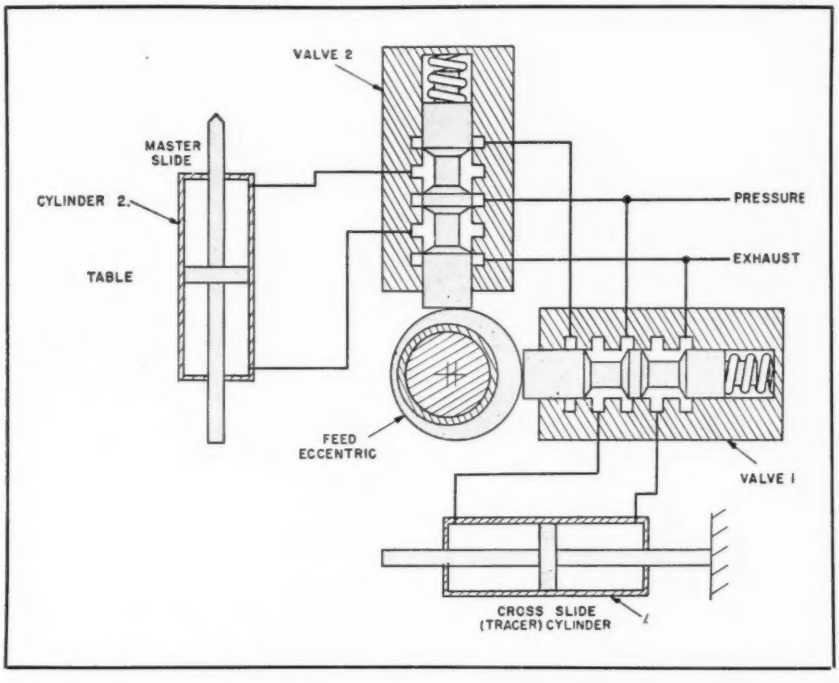


Fig. 4. Schematic plan view of the 360° tracer.

template or it will tend to lose contact. If the motion is such as to cause the tracer to leave the master, the tracer valve will then move to a negative position and will cause the motor to rotate the tracer eccentric and the feed eccentric in a counterclockwise direction. This rotation will affect the direction of feeding so that the tracer is again tangent to the master. Simultaneously, the tracer valve is restored to its neutral position. If the motion is such as to cause the tracer to overdeflect, an opposite action occurs to restore the valve to its neutral position.

Since the tracer eccentric and feed eccentric rotate in unison, any requirements for a new direction of feeding cause both to rotate in such a manner as to correct the direction error. As shown in Figure 3 the direction of tracing is counterclockwise; but, if the lines to the motor were to be reversed, the direction of tracing will be clockwise. To facilitate reversal of the direction of tracing, a reversing valve is provided.

As we stated previously, the feed rate is dependent upon the value of eccentricity of the feed eccentric. In the actual machine, means are provided to change this eccentricity from zero through any value up to the maximum rate. Since the 360° tracer controls the direction of motion, and the rate of motion is independent of the tracer, we can say that the system represents true first-derivative control.

The tracer valve controls only the low inertia hydraulic motor and for that reason it can be made to be extremely sensitive. Any oscillation of this tracer valve will have only a secondary effect on the slides. In practice, a high-frequency, low-amplitude oscillation of this servo loop improves accuracy with no discernible effect on the workpiece. This 360° tracing system has found wide usage in many different applications. One of the most outstanding applications so far has been for the production milling of airplane engine parts. In certain of these, four engine parts are machined from one master simultaneously.

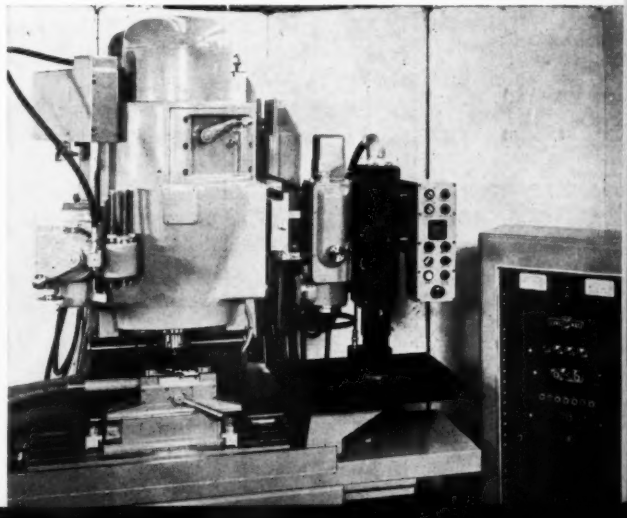


Fig. 5. A single-spindle profiler equipped for line tracing directly from drawings.

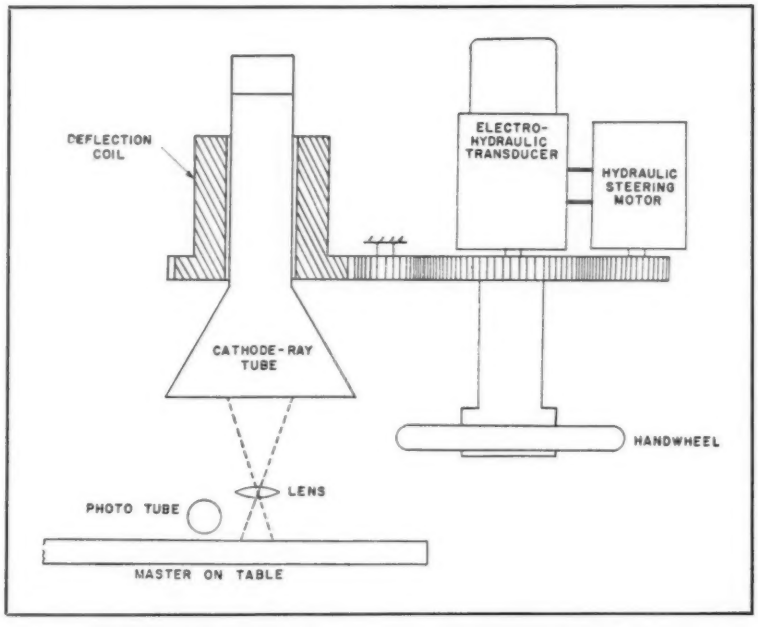
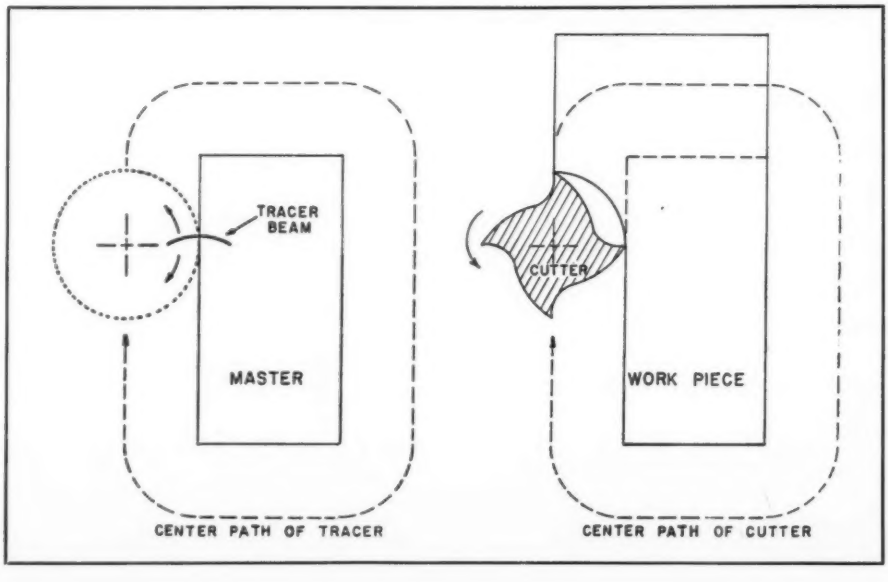


Fig. 6. Schematic elevation of line tracer. Control system for the line tracer uses a "flying spot" from the cathode ray tube to scan the master drawing.

In the single-spindle profiler equipped for line tracing directly from a drawing, Figure 5, the tracer head and control panel are attached to a standard 360° profiling box, exactly the same as is used for the four-spindle profiler, Figure 2. The entire electronic control is housed in a single cabinet. Since the Line Tracer works in conjunction with the standard tracer system, it is adaptable for all Cincinnati machines which have 360° servo control. Of those cited earlier, the four-spindle profiler, the 30" Hydrotel unit, and the skin miller all may be used with a Line Tracer.

The control system used for line tracing, Figure 6, is almost the same as that for finger tracing. In fact from the steering motor on, both systems are identical. There are certain conditions required both for finger and line tracing. The eccentricity of the feed cam and of the sensing unit must always be in the same direction. The feed rate must be constant in all directions. In the case of line tracing, the

Fig. 7. Method of cutter compensation. As a small bowed arc, the tracer beam describes a circle whose diameter must equal cutter diameter. Line being traced bisects arc as perpendicular.



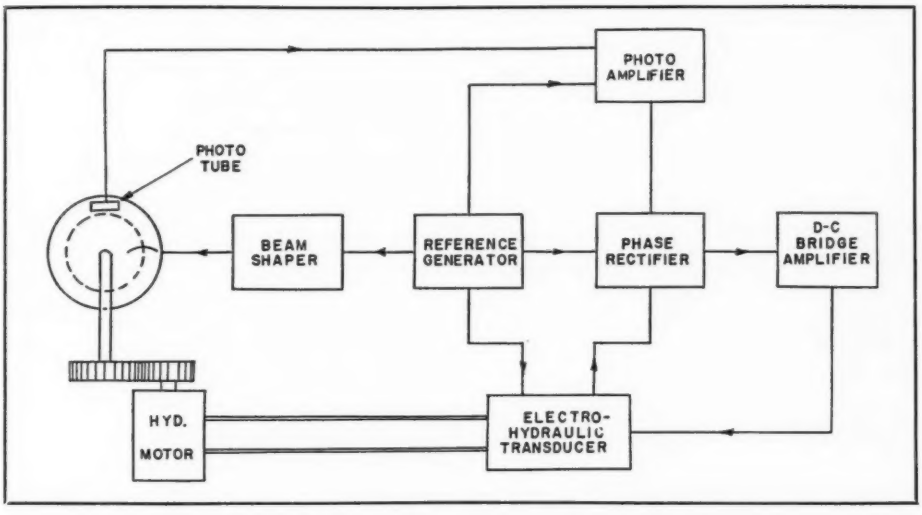


Fig. 8. Block diagram of the servo system for the line tracer.

constant feed is obtained just as in finger tracing. However, the two eccentricities are interconnected in an entirely different manner.

The characteristic feature of the Line Tracer is the use of a cathode-ray "flying spot" tube to provide a source of light which is projected onto the master drawing. The spot of light is modulated vertically and horizontally on the face of the tube by a reference generator and a beam shaper to produce a small, bowed arc. The deflection coils around the tube are geared to rotate with the hydraulic steering motor and the feed cam. The light arc is so oriented that the convex side always points in the same direction as the eccentric on the feed cam. Therefore, the amount of bow in this arc is a measure of sensing eccentricity.

In addition to the modulation of the beam, it is also deflected by permanent magnets so that the beam describes a circle as it rotates with the steering system. The diameter of this circle is adjusted to equal that of the cutter being used. The adjustment of the circle size can be likened to the selection of tracing fingers of a size equal to the diameter of the cutter to be used. From these relationships it may be seen, Figure 7, that the line being traced is the perpendicular bisector of the modulated tracing beam. Since the beam can rotate only forward and back along the dotted line, when a corner is reached it is necessary for the machine to travel as shown by the dashed line in order that the sensing beam remain on the pattern being traced. Since the diameter of the circle in which the beam rotates is made equal to the diameter of the cutter, the location of the beam will be related to the master in the same way that the tangent of the cutter relates to the workpiece.

To accomplish sensing in the Line Tracer, the motor steering valve has been replaced in the servo system, Figure 8, by an electro-hydraulic transducer, consisting of a pilot-operated valve driven by a moving coil with a differential transformer as a feedback element. The minor loop consists of the transducer, phase rectifier, and a d-c bridge amplifier. The neutral position of this loop is matched to the center position of the valve. Therefore, with no error signal, there is no rotation of the steering motor.

As the modulated beam scans across the white line being traced, pulses of light reflected by this white line are converted by the phototube into electrical pulses. These pulse trains are fed to a photoamplifier where they are converted into an error signal. This error signal is zero (or minimum) when the beam is centered over the line.

In operation, if the beam is deflected to one side of the line, the output from the photoamplifier causes a polarized d-c output from the phase rectifier which, in turn, causes a deflection of the moving coil. The electro-hydraulic transducer is deflected, causing rotation of the motor, which turns both the feed cam and the scanning beam in such a direction so as to bring the beam to the central or balanced position.

From the practical standpoint, this system offers several important advantages other than the obvious benefit of working directly from a drawing. Since pulses are obtained from both sides of a line, the width of that line does not affect tracing accuracy. Also, any line traced may cross other lines so long as the intersecting lines do not meet at angles greater than 45°. This is important since it permits

tracing of sharp outside corners and intersecting grooves. Furthermore, as it is possible to trace a pattern in two directions, mating parts can be made from a single line drawing; since the cutter compensation is adjustable, the fit between them can be varied. With this system it is, therefore, possible to make a complete blanking die with strippers from a single line drawing.

Due to the fact that the Line Tracer is a differential system, no power supply regulation equipment is required, nor are any close tolerance or ruggedized components needed.

The Line Tracer may be most effectively used for profiling operations in which relatively small quantities of a great number of different forms are to be traced. The value of Line Tracing is also increased as the size of the part is increased, due to the greater ease with which masters may be handled and stored. Normally, the Line Tracer reproduces directly, in a one-to-one ratio. However, for more accurate work the drawing master may be drawn to a scale of four to one, or even ten to one, and reduced photographically in making the tracing master.

Since the accuracy of the finished piece can only be as accurate as the master drawing, in preparing the master drawing the draftsman must be more careful than normally. In joining lines, he should not leave any gaps or permit lines to overlap, producing an irregular, wide segment in the line. Also, accuracy in dimensions becomes more important. At present, all of the Line Tracer work has been done with white line on a dark background. However, tracing black lines on a white background is completely practical.

Although the Line Tracer cannot be said to provide solutions for all tracing problems, when correctly applied, it is an effective and economical answer to many particularly difficult problems in the field of tracing.

end

Precise Control Optimum in Welding

The Sciaky Bros., Inc., of 4915 West 67th St., Chicago, have a tradition in firsts in welding machine development and manufacture.

The success of a weld depends on the control of the variables involved. So to this end, precise control, Sciaky has developed the Dekatron principle of welding machine control.

The Dekatron tube counts the cycles of the line frequency; it can be seen that control, then, is as accurate as the accuracy of the U. S. Naval Observatory time signals. The power company line frequency requirements are obtained from the Naval Observatory.

Previous to the Dekatron system, counting or timing was done vocally and later with manually operated counters, electro-mechanical step-by-step switches, electronic counting circuits, capacity timing networks, relay sequencing, etc. All of these had their shortcomings.

The Dekatron is a cold cathode type of tube, which employs one anode and ten cathodes. Glow transfer from one cathode to another offers a consistent preset count.

Plug-in tube units emulate the plug-in trend which offers low maintenance and a minimum of downtime. Extra welder functions are easily added by this plug-in feature.

The dial principle for control means consistency and easy duplication, plus synchronization of functions, as the calibrations of individual plug-in units are in cycles and impulses of secondary current.

Sciaky rectifiers are also radically different, and offer a wider range of heat control. An unbalanced condition between successive impulses of alternate polarity are eliminated, as well as the commutation fault.

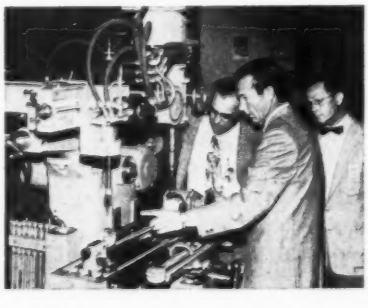
Consistent with other new principles of this machine is the phase shift control dial, which provides approximate linear adjustment of secondary current.

Three-Dimensional Tracing Featured in New Machine

A recent demonstration of three-dimensional tracing, performed on the new Axelson 10RH milling machine, showed this type of milling machine as having new features which are particularly applicable to fast production, experimental, or prototype operations.

It has hydraulic feeds from 0" to 80"/min. It also may be used for conventional milling without the tracing equipment.

In this new machine, developed by Axelson Manufacturing Company,



Division of U. S. Industries, Inc., 6160 South Boyle Ave., Los Angeles 58, Calif., the hydraulic cross feed cylinder has been enclosed in the ram rather than on the knee in front of the machine. Also, the reversible ram carries a vertical all-angle spindle head on one end, and slotter head on the other. The combined turret slide and table travel is 44", the ram and cross feed travel is 26", and there is 22" between the spindle and the top of the table.

PNEUMATICS SECTION

TOOLING and PRODUCTION
Air Power
FOR METALWORKING

It's Not a "Breeze" to

. . . SAVE MONEY

by William E. Hoffman
Associate Editor

YOU CAN'T "MAKE IT" if you keep throwing money away. An industrial operation that is dependent on low cost continuous operation can not stand frequent emergency repair; neither can it afford to throw money into the atmosphere, by way of leaking air tools.

A "going" concern must subsidize orderly procedures for knowing the condition of its equipment at all times. To "lick" repair bills and time as well as frequent equipment replacement, a program should be started or reviewed with preventative maintenance as its keynote. The instrument for carrying out this program would be inspection.

A study should be made of the equipment, of the work the equipment performs, and of the conditions in which the work is done. You can set up a systematic procedure, or have it done for you through a consulting service. If you do it yourself, we suggest that you follow the recommendations of the equipment suppliers.

TYPE OF EQUIPMENT	LUBRICATION	BEARING CHECK

Cost of
— AIR LEAKAGE —
Figures are approx.

Orifice Dia.	60 psi	80 psi	100 psi
1/16	$7.+	$9.+	$11.+
1/8	$29.+	$37.+	$44.+
1/4	$114.+	$145.+	$176.+

Cost estimates are for a month.

Figured at $.07/1,000 cu. ft.

Average size cylinders can leak equivalent to 1/8" dia. hole.

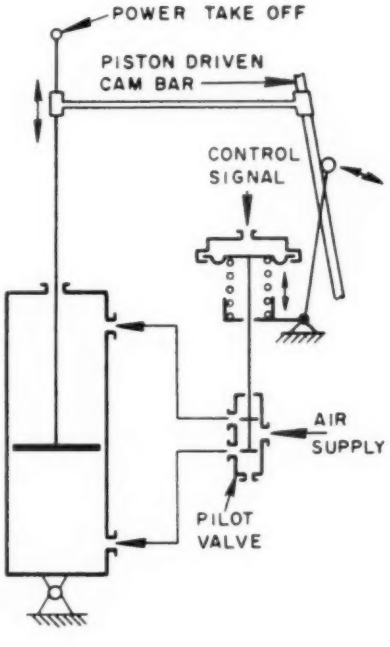
Piping Revelation Found in Plastic Bundles and Strips

Rather than string individual tubing for pneumatic control, pilot, and instrumentation circuits, the harness-type bundle or strip of plastic tubes has been gaining great favor. These are similar to the harnesses that go to make up the electrical system of an automobile.

The tubes are extruded individually and then bundled or laid side-by-side and encased in plastic. The benefits of color coding can be had, with any number of tubes to the bundle or strip (up to ten in the strip and nineteen to the bundle).

Samuel Moore & Company make the tubing to operate in the 10 to 30 psi pressure range. They also supply companion equipment such as junction boxes, manifolds, and couplings.

tained by changing the shape of the cam. The cylinders are designed to use shop air at 100 psi pressure.



COMPRESSED AIR MAGAZINE 57

Pneumatic Power Positioner

Suggested this to Wilson, for his dept. If he wants more info' - see letter from Hagan Corp. in file.

LESS NOISE FROM INDUSTRY

by John Decibel

INDUSTRY HAS BEEN PRESSURING the pneumatic supply salesmen to give them equipment which will operate on lower noise levels. The manufacturers of this equipment are working on the problem; they are finding it will take a great deal of time to bring about satisfactory results.

To accomplish an appreciable decrease in the noise hazard, short steps will have to be taken. The pneumatic industry can't take large steps in this direction—it's a matter of development. The answers have to be worked out, plus the change-over period (pneumatic equipment being used now must serve its life-term).

The biggest problem confronting a development program is to reduce the noise without sacrificing other desirable features, such as product compactness and power.

Of the three major classifications of pneumatic tools the percussion type is the noisiest. However, I hasten to say that the ambient noise level of the work performed by these tools is usually as great or greater than the noise of the tools themselves. This is not to say that the rotary and reciprocating pneumatic tools are no problem from a noise standpoint.

When the study of noise suppression started to take hold, the users of pneumatic tools found little satisfaction or comfort from the fact that there were others not using pneumatic tools that had bigger noise problems.

The noise level of the average factory operation is around 100 decibels (a decibel is a unit for measuring the loudness of sound); the average business office is around 70 decibels. The study is deeper than one would think; for instance, you will find the use of the sone, the phon, and microbars for different phases of sound measurement. The sone is a 1000-cycle tone with a sound pressure of 40 decibels*.

. Tested individually, pneumatic tools often fall within the safe-to-comfortable noise range. But they are not very often used individually and therein lies the crux of the need for further development and research. Nor are we only interested in having the tools fall below the injurious noise level —comfort is becoming of more and more interest to the working man.

Most pneumatic tool noise comes from the exhaust port or ports, and is airborne to the offended. The blades of a rotary motor as they pass the exhaust slots; the distributor valves of a piston motor opening to exhaust (causing a whine); and the expanding and contracting of gas passing through the orifice (causing a hissing sound) are the more common reasons for noise being a problem. If we ask for less noise, we are probably in the same breath asking for smaller tools. Both we should have, but when we decrease the size of the tool we must increase the speed . . . if we expect to keep the same power. If we increase the speed to maintain the power, we are at the same time increasing the noise producing movement. You see, it's not easy.

We have heard much

Approximate Air Needs of Air Tools—c f m:

Grinders, 6- and 8-in. diameter wheels	50
2- and 2½-in. diameter wheels	14-20
File and burr machines	18
Rotary sanders, 9-in. diameter pads	55
Sand rammers and tampers:	
1x4-in. cylinder	25
1¼x5-in. cylinder	28
1½x6-in. cylinder	39
Chipping hammers, 10-30 lb.	28-30
2-4 lb.	12
Nut setters to 5/16 in., 8 lb.	20
½ to ¾ in., 18 lb.	30
Paint spray	2-20
Plug drills	40-50
Riveters, 3/32 - to ⅛-in. rivets	12
larger, weighing 18-22 lb.	35
Rivet busters	35-39
Steel drills, rotary motors:	
To ¼ in., weighing 1¼-4 lb.	18-20
¼ to ⅜ in., weighing 6-8 lb.	20-40
½ to ¾ in., weighing 9-14 lb.	70
⅞ to 1 in., weighing 25 lb.	80
Wood borers to 1-in. diameter, weighing 14 lb.	40
Air cylinders, single acting:	
2 in. bore, per in. of stroke	.013
3 in. bore, per in. of stroke	.028
4 in. bore, per in. of stroke	.050
5 in. bore, per in. of stroke	.079
6 in. bore, per in. of stroke	.114
8 in. bore, per in. of stroke	.192

Source for above unknown

Remind Engineering to use Quick Disconnects on their new test stand.

about the elimination of moisture in the pneumatic power system; indirectly the elimination of moisture in the system helps to decrease noise. It is axiomatic that expanding gases take on heat. This being understood, it is easy to see how the expanding exhaust gases would pick up heat from the immediate area of the orifice and consequently lower the temperature of the orifice. The temperature frequently gets below zero at this point and the moisture in the gas forms ice. If ice is formed, the orifice will be closed down, and the smaller it becomes the louder the noise of the gas as it passes through.

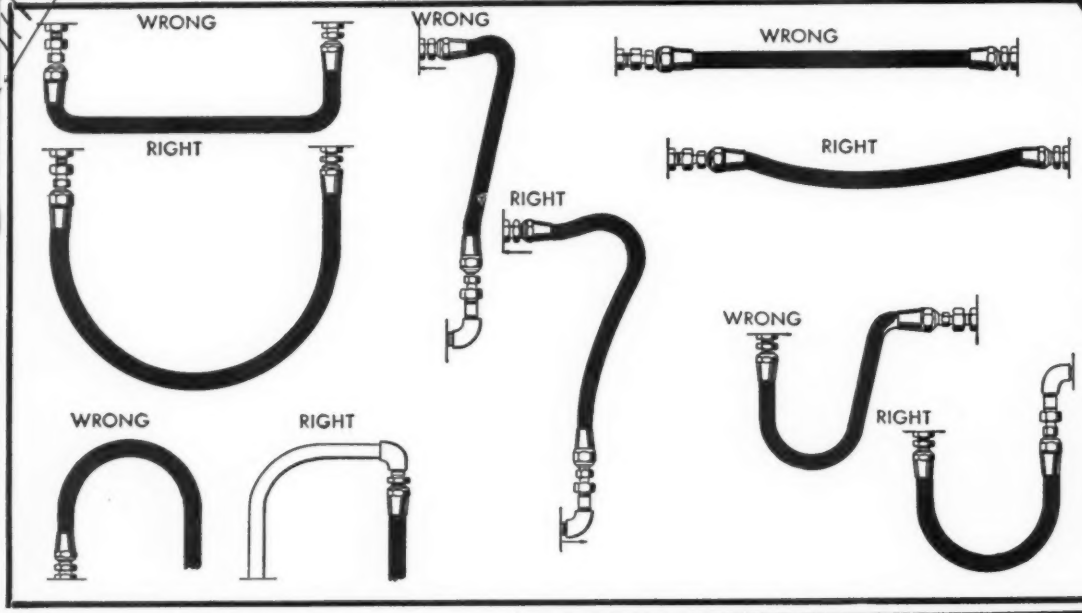
The most obvious remedy would be to replace the offending tool with one which has been engineered to make less noise. As we mentioned before this is not always feasible and will take time. The remedy method of isolating the tool, and the operation causing the noise, is not very often a workable solution either.

The most immediately effective remedy is the adaption of devices which can be introduced into the flow path of the gases carrying the noise.

A decrease in noise level can be found in the use of an expansion chamber that has been calculated to handle the frequency of the tool creating the noise. For example, it has been found that a tool cycling at 1000 cps could be quieted by using a 3" long expansion chamber on the exhaust port. This would have a 16-to-1 ratio of sectional area to port area, and would lower the noise level 20 decibels. Other tools cycling at faster or slower speeds would have respectively longer or shorter expansion chambers.

Mufflers are available and other devices will appear, along with tools which are inherently less noisy — it's just a matter of time.

"Handbook of Noise Measurement," Arnold P. G. Peterson & Leo L. Beranek. Published by the General Radio Company, Cambridge, Mass.



Recommended Minimum Hose Length for 180° Bends

Hose I. D.	Length	Hose I. D.	Length
1/4"	15"	3/4"	24"
3/8"	17"	1"	30"
1/2"	19"		

Hose size is generally based on the inside diameter of the hose.

Courtesy THE HANSEN MANUFACTURING CO.

MANUFACTURING MEMOS

Machine Design Award Program . . .

● The James F. Lincoln Arc Welding Foundation is sponsoring a $25,000 machine design award program for industrial processing machinery; construction and mining machinery and jigs, fixtures and tooling. Deadline for entries is July 15; rules booklet available from the Foundation, Cleveland 17, Ohio.

Acquisitions . . .

● Sightmaster Corp. has acquired Mutual Electronic Industries Corp., a producer of patented cable and panel equipment and tri-axial connectors. Both firms have plants at New Rochelle, N. Y.

● Purchase of the die casting firm of Stemac, Inc., of Denver, has been announced by C. A. Norgren Co. The newly acquired company will be known as Norgren-Stemac, Inc.

● The Gairing Tool Co. has sold its assets to the Ernest Kanzler interests of Detroit. Don F. Morse has been appointed to serve as vice president and general manager.

● The acquisition by Ex-Cell-O Corp. of Cadillac Gage Co. of Roseville, Mich., and the Smith Bearing Co. of Trenton, N. J., has been disclosed. The two firms will operate as separate units under their existing managements.

● Consolidated Electrodynamics Corp. has bought the major assets of R. A. Castell & Co., electronic components manufacturer.

Ford Gifts to Establish Dearborn Center . . .

● Gifts of 210 acres and $6,500,000 have been offered to the University of Michigan by Ford Motor Co. and the Ford Motor Co. Fund. They will be used to establish a Dearborn Center of the University, with an enrollment of more than 2,700 students. The gifts have been accepted tentatively, dependent on the state's willingness to provide funds to operate the proposed center.

● More than a 25% increase in production and sale of valves for the country's industrial pneumatics industry has been predicted by Ross Operating Valve Co. Ross is the world's largest producer of air control valves.

● Plastics production passed the four billion pound figure last year by increasing 10% over 1955. This estimation was made by The Society of the Plastics Industry, Inc. The production record established the plastics industry, for the first time, as a two billion dollar industry.

The Investment Casting Institute, at its fourth annual meeting, honored six of its members. Awards were presented to Kenneth M. Bartlett, Ted Operhall, Dr. Nicholas J. Grant, Roger Waindle, Edward G. Chapman, and Dr. Richard A. Flinn. These men were singled out as having contributed in many ways to the welfare and progress of the Institute and to the investment casting industry.

◆

General Telephone Corp. has formed General Telephone Laboratories, Inc., with headquarters in Chicago. The newly-created organization has acquired the research and development personnel and facilities of Automatic Electric Co., principal manufacturing unit of the General Telephone System. It will be involved in a greatly expanded program of basic research and product development in the telephone switching and related communication fields. The Laboratories will also deal with quantity analysis and measurement for all units of the GT System.

◆

A new Eastern carbide metals shop covering about 5,000 sq ft, was recently completed by the Metallurgical Products Department of General Electric Co. The facility located in Kenilworth, N. J., is geared to process small quantities of specially-shaped cemented carbide tools.

◆

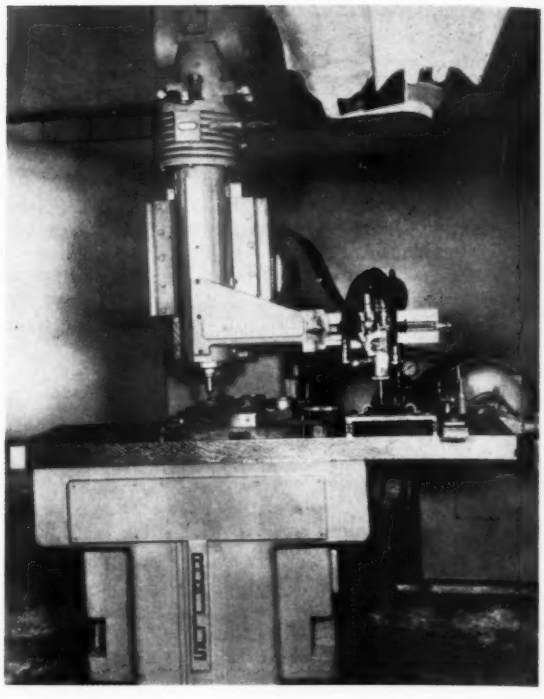
A. Milne & Co. became A. Milne & Co., Inc. on the 70th anniversary of its founding, on January 1. The firm is a nationwide distributor of solid and hollow tool steels.

◆

Modern Corp. has changed its name to Modco Tools, division of Valeron Corp. The company is one of the country's largest producers of special tooling. The name change was made in order to identify the firm more closely with its products and services.

◆

Dana Corp. recently celebrated the golden anniversary of its first shipment of one automotive universal joint to the Mack Brothers Motor Car Co. Dana was then doing business as Spicer Universal Joint Mfg Co.



This Romulus Hydro Cycle incorporates a hydraulic spindle and milling head capable of 3-dimensional motion. Fluid motor is on top of the machine. Power unit is not visible.

HYDRAULIC MILLING HEAD TAKES BIGGER CUTS FROM HARDER METAL

PRODUCTION ENGINEERS, especially in the steel and aircraft industries, are overcoming an old metal cutting problem with a new constant horsepower, variable speed milling head. This new hydraulic method can duplicate complex parts in one-fourth the time older practices require.

Taking bigger cuts from harder metals has always been complicated by the proportional relationship between horsepower and speed in standard milling heads. The larger the cut of metal, the slower the machine must be operated. But the slower the machine is operated, the less horsepower it generates, and the less metal it removes.

This problem led to the recent formation of the Romulus Tool and Engineering Company. It was created by a group of production men who were convinced of the need for an efficient hydraulic spindle that could handle milling heads and other tool attachments. Romulus engineers set out to design and produce a milling head that would develop constant horsepower over a wide speed range.

Romulus' first approach was to use its previously-designed planetary gear system. The idea was to drive the inner and outer gears from separate fluid motors. The center gears would be driven at a rate determined by the difference in speeds between the outer and inner gears. To design the hydraulic power system, Romulus called in application engineers of the Denison Engineering Company, a leading designer and manufacturer of hydraulic motors, controls, pumps and other equipment.

Denison, in following the planetary gear system approach, was able to maintain the speed difference constant, but could not achieve a constant horsepower system. This impasse led them to shift to an entirely different class of equipment — axial, piston-type, variable-volume fluid motors.

This type of motor, used in conjunction with a constant volume pump, delivered the desired result. When displacement of the motor is reduced (for example, from 100 to 50%), horsepower remains the same because the motor is actually rotating at double speed. Torque output is halved, because the horsepower output of a fluid motor is proportional to both torque (displacement) and speed.

Denison application engineers working with Romulus developed the new hydraulic system which develops constant horsepower over a wide speed range.

Romulus now uses this Denison hydraulic system as the standard drive for all their variable-speed, constant horsepower hydraulic spindles. These spindles, made in sizes ranging up to 50 hp, deliver constant horsepower over a wide speed range. Use of the fluid motor alone gives a speed range of approximately 4 to 1. Installation of additional gear trains can increase this range to as high as 81 to 1.

This hydraulic spindle delivers maximum horsepower per pound of spindle, important because spindle heads must usually be counterbalanced. Rigidity of the head and precision bearing construction make the spindle sturdy and precise. Romulus equips the compact and economically-operated unit with hydraulic controls that can instantly reverse the cutter. The spindle is used as a permanent attachment on some machines, or as a temporary attachment on others — for example, to convert a planer to do milling work.

The Romulus Hydro Cycle shown in the photograph consists of a hydraulic power unit and a milling head capable of three-dimensional motion. These motions are generated by a three-dimensional hydraulic tracer. The hydraulic head exactly follows the motion of the tracer over the contour to be reproduced.

Development of this spindle, and subsequent improvement of heavy-duty metal removal, is an example of application engineering's contribution to metalworking progress.

end

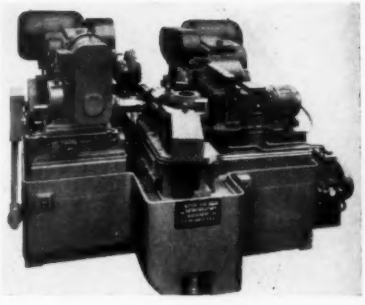
Special Machines

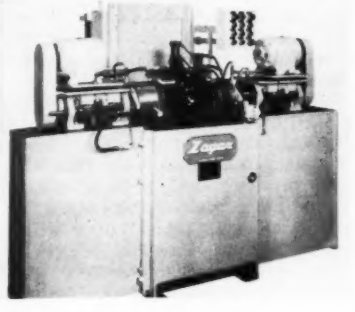
SPECIAL MACHINE MILLS, DRILLS, BORES AND REAMS

Multiple operations have been incorporated in the design of a special machine for processing farm equipment transmission housings. Simultaneous milling of two surfaces, drilling, rough boring and reaming are performed on 27 parts/hr. The loading end of the machine is shown where the operator loads the part in the fixture.

The table rapid traverses to the rear and then feeds past two opposed milling heads. After milling on return forward, three holes are drilled on one side and the cored opening at the neck of the case is rough bored on the opposite side, simultaneously. The table advances to the third and final station where three holes are reamed by the same six-spindle head used in drilling these three holes. All operations are automatic between load and unload. All clamping, movements and feeds are hydraulically controlled.

This machine was designed and built by The Motch & Merryweather Machinery Co., Machinery Manufacturing Div., 888 East 70th St., Cleveland 3.





DRILLING VARIETY OF HOLE PATTERNS

The screw holes in three revolver handles and barrel holder, that swings downward, are completely drilled by two Zagar drill heads. The change from one part to another is accomplished via the fixturing.

Each fixture holding the revolver handle is self-contained and can be inserted in the machine quickly. The drill heads, mounted on opposed feed units on either side of the work-holding fixture, are rotated to the proper position of the specific handle being drilled.

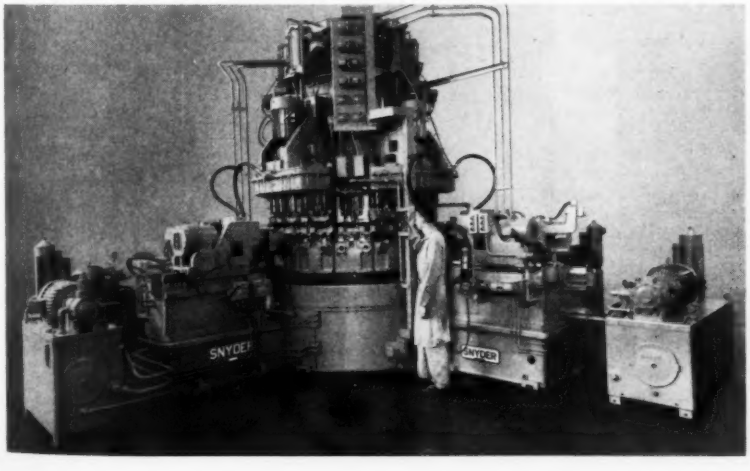
Automatic cycling, approach, feed, and return are hydraulically controlled. The combination of drill heads, Zagar feed units, and the multiple fixture makes limited production economical because all holes are drilled in one pass.

The machine was designed and built by Zagar, Inc., 23894 Lakeland Blvd., Cleveland 23.

HIGH PRODUCTION MULTI-OPERATION 16-STATION MACHINE

A new 16-station center column machine featuring a heavy-duty 7-sided column that resists high machining thrust loads has been designed and built for the automotive industry. This new machine drills, countersinks, chamfers and reams automotive steering gear ball nuts at a net production rate of 331 pcs/hr.

The machine, built by Snyder Tool & Engineering Co., is one of the largest of its type ever built and has a 96" dia index table. The machine develops a total of 181 hp and delivers coolant at the rate of 150 gpm.



Three SAE 5620, 2½" long steel ball nuts having a 1⅝" x 1⅞" round-cornered square section are clamped in each of the 16 fixtures on the machine. The nuts, which have previously machined rack teeth in the blanks, are located in the fixtures from these rack teeth. Hydraulic clamping means are provided for the parts.

Large vertical thrust loads, which made the special heavy-duty center column design necessary, are imposed by (two) 3-spindle, (two) 9-spindle, (one) 12-spindle and (one) 18-spindle vertical heads that drill, flat-bottom drill and radius chamfer four recirculating ball holes as well as tap drill and chamfer one hole in the same part face.

Previously, household and commercial compressor shells and covers were welded together by submerged arc using carbon flux as shield. Compressors were placed in revolving fixture.

Welding Spatter Problem Solved by Simple Method

KELVINATOR'S Detroit plant has undergone many internal changes recently as the company "tooled up" and laid out new assembly lines for production of a new hermetic compressor.

Among the manufacturing changes made possible by the design of the new compressors was the inauguration of production welding using an inert-gas shielded arc, instead of a carbon flux shield, to prevent oxidation.

This hermetic seal, essential for long and trouble-free life of compressors, must be attained in a way that prevents dust or dirt from entering the vacuum-cleaned interior. Butt-welding the cover plate to the shell by submerged arc tends to spread the flanges of the new compressors. The reverse lip flange of present compressor models did not pose this problem.

First experiments with inert-gas shielded arc process, using carbon dioxide gas as the shield, indicated it would not only give an excellent seam weld but would also offer important production savings. After fixturing and timing were solved, the equipment was installed in the production line.

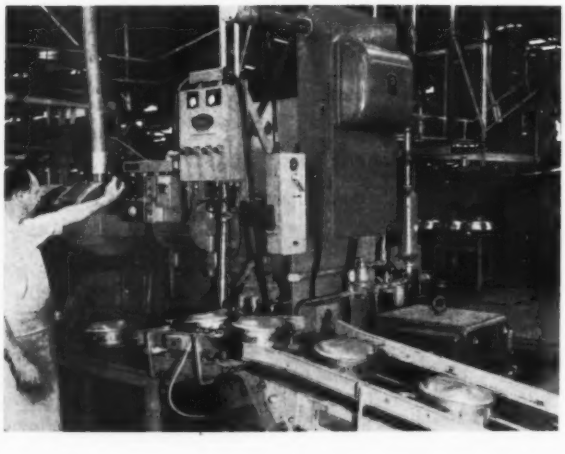
Here, a serious problem developed that was not apparent in the trial setup because of the smaller number of units run through the testing. Spatter, inherent where CO_2 is a shielding gas, accumulated on the gas nozzle and, in the molten form, dropped onto the weld joint ahead of the arc. Generally, a leak developed in the compressor at the point where spatter had dropped off the gas feed nozzle.

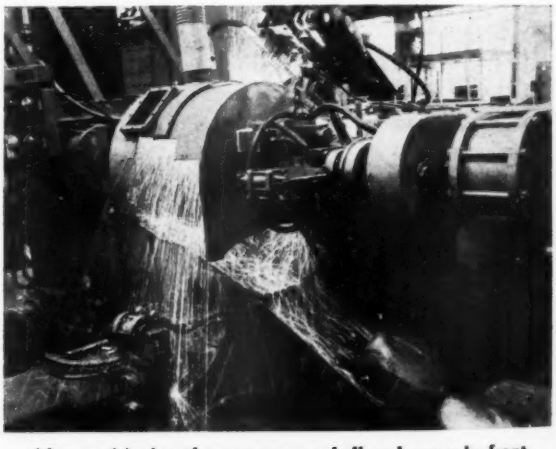
The accumulated spatter would also solidify on the gas feed, causing it to clog and to distribute the CO_2 shield improperly around the welding arc. Spattering can be reduced considerably by shortening the arc, but even with a shortened arc, Kelvinator discovered that fine spatter continued to build up on the gas feed which surrounds the welding wire.

The problem was eliminated by running a copper tube down the side of the welding head to the welding wire. Carbon dioxide was cut off from the regular gas nozzle and fed through the copper tube. Position of the copper tube provides an effective gas shield, but, at the same time, partially removes the tube from the path of continuous spatter. The high heat conductivity of copper also tends to reduce adherence of the spatter.

Welding with a CO_2 shield is performed on an automatic welder that produces at a rate of approximately 100 parts/hr. Compressors arriving on a conveyor are placed by the operator in the fork of each automatic welder. The fork picks up the compressor and moves it into position in front of a stationary welding head. After a protective cover slides over, the compressor shell and cover are welded together while rotating 360° in front of the arc. After the compressor has been welded, it is ejected from the machine and slides down a chute. end

Moving on a belt conveyor from the assembly line, the new hermetic compressors arrive at the automatic welders which use CO_2 gas as a shield against oxidation. A clamp holds cover of compressor shell until unit has been placed in welding machine.



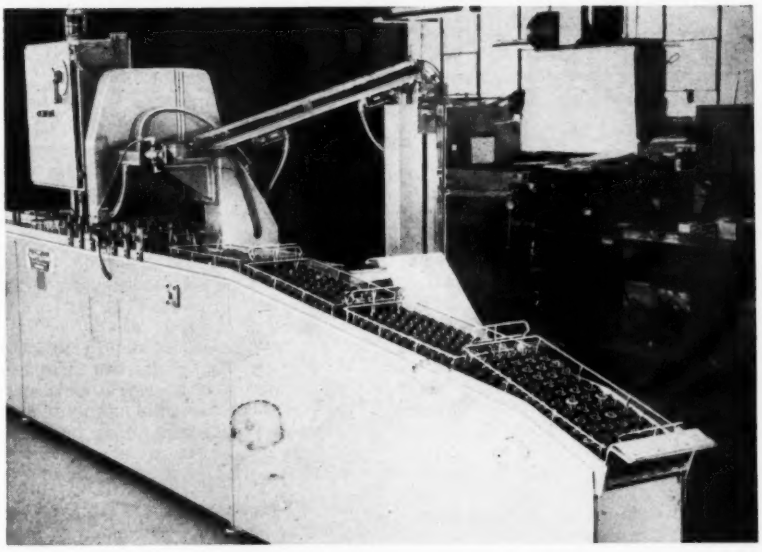


After positioning the compressor shell and cover in front of a stationary welding head, a protective cover slides over the work. As the workpiece is revolved 360° in front of the arc, the shell and cover are welded together and then ejected onto a chute.

AUTOMATIC HANDLING

AUTOMATIC BASKETING OF PARTS BOOSTS LINE EFFICIENCY

A new high-speed method for automatic "basketing" of parts prior to, during, or after processing has been developed which boosts the efficiency of automated production lines. As shown here, the principle is used to basket small center-bored pinions — up to 1⅛" P.D., at a loading rate of 3000 pcs/hr, as they come from a Michigan electro-audio tester. Although each basketing unit is custom tailored to a specific job, it is assembled from standard components. Adaptability to any part loading operation is therefore virtually unlimited.



In operation, parts are fed to a dropping mechanism through an enclosed track using chain lifts and gravity flow. Rate of feed is variable through standard interlocked limit switches — with all handling, even at high speed, gentle enough to assure delivery of unmarred parts.

As they leave the incoming track, the rolling parts are guided and tipped through a curved channeled fixture and held positively at the bottom end. Release into baskets is from this point and is actuated by automatic indexing of the basket. The parts are dropped onto upright basket prongs a row at a time.

Empty baskets enter the unit on a chain conveyor and are horizontally positioned by spring clips. Before passing beneath the "drop", vertical positioning of the basket is effected by locked roller guides. Indexing of the basket is accomplished by limit switches triggered by the chain drive. The baskets stop at the loading station. As each row of prongs in the basket are loaded, the next row of prongs are automatically indexed into place. If desired, double or triple dwell of the indexing can be provided so that two or three gears could be stacked on each prong of the basket. The indexing arrangement is self-controlling as end of the run or a malfunction at the loader will stop the equipment.

The loaded baskets are shunted over gravity rollers and conveyor chains to the next operation.

This equipment has been designed and built by the Gear-O-Mation Division, Michigan Tool Company.

MULTI-TRACK PARTS-FEEDER

The Feed-A-Matic is a versatile, high speed parts feeder and counter. It will handle a variety of parts such as nuts, bolts, screws, studs, washers, dowels, plastic parts, and screw machine parts.

The standard Feed-A-Matic is equipped with a single adjustable track, but where the application requires it, multiple track delivery of from 2 to 5 tracks can be provided.

The feeder illustrated manufactured by U. S. Engineering Company, is adapted to feed four rows of No. 12 x 29/32" long studs to an automatic stud setter to insert the studs into a die casting used in the automotive industry. Four studs — one from each track — are released each time the solenoid controlled release mechanism is actuated.

The hopper consists of a cast drum with cast-in pockets. As the drum rotates, the cast-in pockets collect a quantity of items, carrying them to the orienting chute.

A stationary retainer plate gradually closes the pocket as the hopper revolves, capturing the collected items. At the peak of the turn the retaining plate ends and the part flows into the orienting chute and down the track. Parts not properly oriented are rejected back into the drum. At the end of the track is an adjustable release mechanism that can be set to release one or more parts at a time.

USABLE RECORDS:

Basis of Preventive Maintenance

by C. E. Hutchison
Manager, Factory Planning
Power Transformer Department
WESTINGHOUSE ELECTRIC CORPORATION

NOT MANY YEARS AGO, the maintenance of plant equipment was handled (and handled well) by the old master mechanic who nursed his machines like babies, kept his finger on their collective "pulse" and carried a first-hand knowledge of their weaknesses in his head.

Now, the need for more and more machines has expanded the shops into mammoth plants, often under a single roof. The trend to replace operator skill with automatic equipment has vastly increased the complexity of these machines — and heightened their importance as factors affecting production, quality, and cost.

To meet this production challenge, the old master mechanic has been replaced by a whole organization consisting of managers, trade specialists, and workers. No one member of maintenance knows every piece of equipment in the plant anymore. Few members know *everything* about any one machine.

But, more than just an expanded skilled maintenance organization is needed. Many companies throughout the country with large maintenance organizations are spending vast sums of money on maintenance annually. But are they getting the optimum return on these expenditures? Is the money spent to the plant's best long-range advantage? There is evidence everywhere to the contrary, such as:

- weak spots not detected or remembered in old machine tools, and accepted from suppliers in new tools purchased.
- uneconomical use of obsolete or worn-out equipment, due to lack of data on maintenance costs.
- misuse of machines causing high maintenance costs.
- expensive replacement of large assemblies where only smaller assemblies are defective.

The difficulty here lies not so much with the skills of our maintenance organizations — but with our systems for determining the *cause* of facility failures; specifically, our lack of simplified, systematic methods to collect data on failures in sufficient detail and to use the data to correct current and potential weak points.

Plainly, intelligent actions to prevent and correct machine tool failures must be based on first-hand knowledge of past failures. Major replacement actions should be based on a knowledge of all the little failures added together. Yet how often do we know the total amount spent on maintenance of a punch press, but do not know the detail history of parts failures on that punch press?

Records Are the Answer

We recognized the need for detailed data on machine tool failures, data which could be collected easily but accurately, data which could be used quickly and effectively to correct weak spots in our present facilities and provide for preventive measures to eliminate trouble spots in the purchasing of new equipment.

Here is how we developed a system:

1. Our first step was to organize detailed data in practical, usable form.
   - A. We surveyed the entire range of our plant facilities and identified electrical and mechanical sub-assemblies to cover adequately the wide variety of our facilities. We classified 29 electrical and 41 mechanical sub-assemblies.
   - B. Then we took each group of sub-assemblies and identified all common types of parts. We classified 67 distinct types of mechanical parts and 37 types of electrical parts.
   - C. Next, we cataloged the *reason* for failures. We classified 15 major reasons, based on experience.
   - D. Then we found a way to describe 15 different reasons for the failure of 12,000 different individual units using a "vocabulary" of only 189 terms.
2. We organized to collect these data accurately.
   - A. We coded each sub-assembly, part, reason for failure, and action, and listed them on a small card. (Fig. 1).
   - B. Next, we placed these cards in the hands of our maintenance men and trained them to code each failure when their work is completed, in a space provided on their time slip.
   - C. Finally, we had a key punch card made bearing this information according to the

MACHINE TOOL REPAIRS KEY FOR IDENTIFYING

Part 1—Electrical — Sub-Assemblies

01	Apron	16	Push button
02	Battery	17	Rectox
03	Brake	18	Recorder & Controls
04	Brazer	19	Relay
05	Breaker	20	Rheostat
06	Clutch	21	Rolls
07	Controller	22	Starter
08	Distributor	23	Switch
09	Electrical alarm	24	Switch—limit
10	Furnace—oven	25	Transformer
11	Generator	26	Timer
12	Light fixture	27	Tap changer
13	Magnets	28	Valve
14	Meter	29	Welder
15	Motor	30	Other

Part 2—Electrical — Parts

01	Arc shield	25	Heater element
02	Armature	26	Insulation
03	Bells	27	Insulator
04	Blades	28	Lamp
05	Brushes	29	Leads
06	Brush holder	30	Oil
07	Ballast	31	Plates
08	Battery solution	32	Plunger
09	Carbon	33	Plug
10	Cell	34	Resistor
11	Clock motor	35	Rotor
12	Collector	36	Screw
13	Commutator	37	Shunt
14	Compartment	38	Solenoid
15	Conduit	39	Socket
16	Connectors	40	Spring
17	Contacts	41	Terminals
18	Coils	42	Thermocouple
19	Electrode	43	Thermostat
20	Fan	44	Tongs
21	Finger	45	Tube
22	Fittings	46	Wire or cable
23	Fuse	47	Complete unit
24	Handle	48	Others

Part 3—Reason for Repair

01	Dirt-Oil-Moisture	09	Misalignment
02	Fatigue	10	Modify
03	Incorrect setup	11	Normal wear
04	Incorrect lubrication	12	Over heating
05	Improper setting	13	Overload
06	Improper use	14	Out of balance
07	Installation	15	Shorted
08	Lack of lubrication	16	Wrong material

Part 4—Action Taken

1 Repair 2 Replace 3 "E" Order

FIGURE 1

. . . Continued on page 156

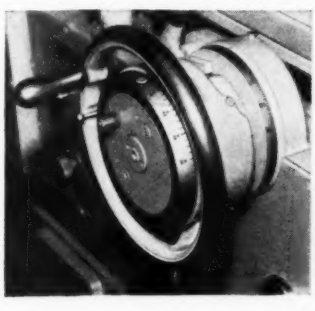
Cincinnati's setup timesavers

reduce cost of your small lot precision grinding

CINCINNATI® FILMATIC 12" x 36" UNIVERSAL GRINDING MACHINE

1

2



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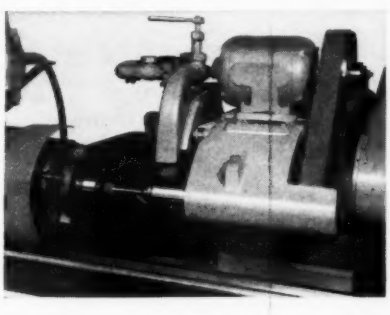

4

5

Small manufacturing quantities may be good for inventory accounting, but they're tough on costs. In precision toolroom grinding, CINCINNATI® FILMATIC Universals offer several ways to eliminate or greatly reduce the setup element of cost.

1 **Power rapid positioning** of wheelhead. Saves time and energy, especially when setting up for widely varying diameters (extra equipment).

2 **FILMATIC grinding wheel spindle bearings** require no adjustment for any job assigned to the machine.

3 **Two-speed cross feed mechanism** facilitates multiple diameter grinding; incorporates pickfeed all the way to final size.

4 **Internal grinding unit** is hinged at the front of the wheelhead casting, always ready for internal work.

5 **Instant work speed selection** for the diameter being ground. Just turn the dial with one hand, that's all there is to it.

Other ways in which new CINCINNATI FILMATIC 12", 14", 18" Universal Grinders can reduce costs in your shop are outlined in catalog No. G-663-1. May we send a copy to you? You will find brief specifications in Sweet's.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

CINCINNATI

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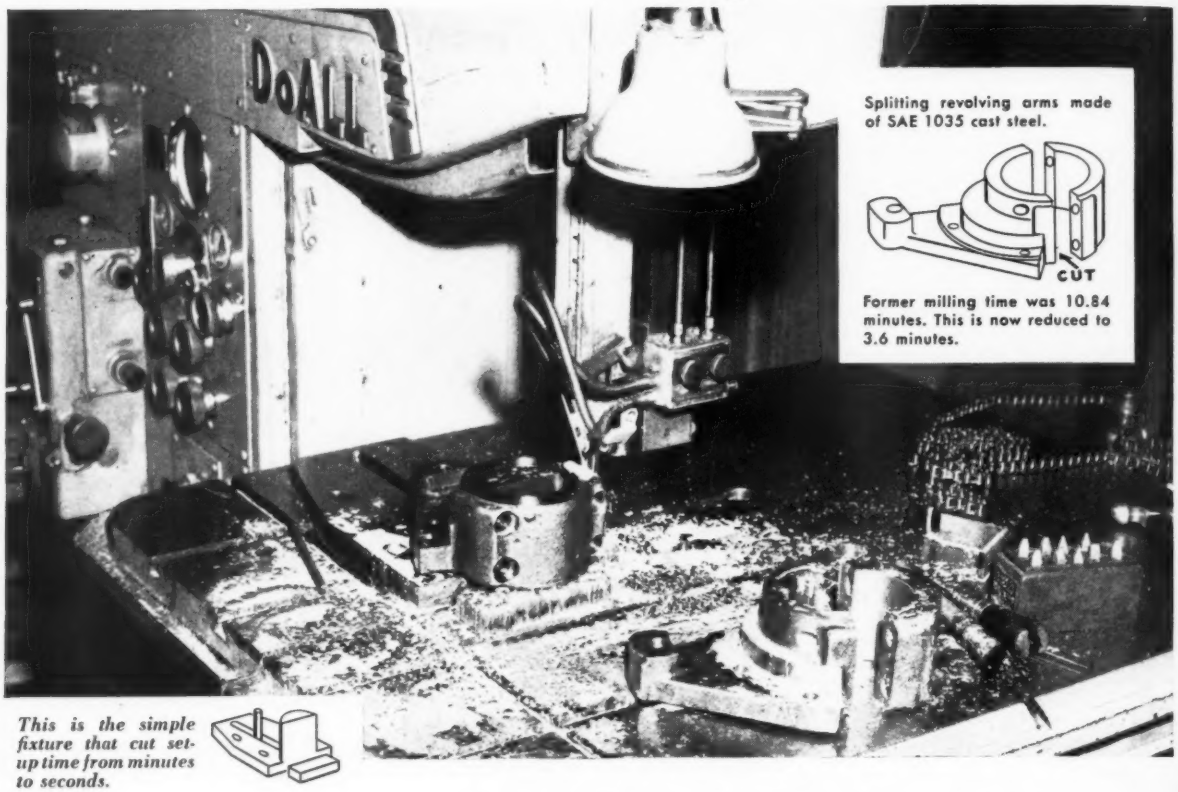
CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • ROLL GRINDING MACHINES • SURFACE GRINDING MACHINES • CHUCKING GRINDERS • MICRO-CENTRIC GRINDING MACHINES • CENTERLESS LAPPING MACHINES

CIRCLE INFORM-A-GRAM KEY NO. 121

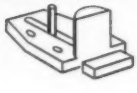
How Production Band Machining Cuts Splitting Costs

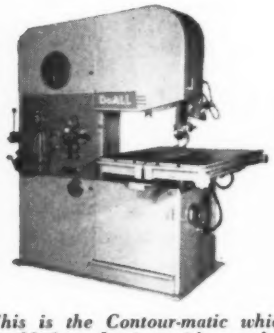


Splitting revolving arms made of SAE 1035 cast steel.

Former milling time was 10.84 minutes. This is now reduced to 3.6 minutes.

This is the simple fixture that cut set-up time from minutes to seconds.





This is the Contour-matic which doubled production with a carbon steel blade.

This is the Demon H.S.S. blade that boosted production 3 times greater than originally done on a milling machine.

Faster Cutting and Reduced Setup Time Increase Production

Literally thousands of splitting operations now being performed by other methods can be done at lower costs with DoALL production band machines.

For example, at one company, the number of "revolving arms" split in an 8-hour day jumped from 44 to 84 when band machining replaced the previous machining method... and when Demon high-speed steel blade was used instead of carbon steel saw band, production rose to 133 a day. Accuracy and finish were excellent, well within tolerances.

The inexpensive, exceedingly simple fixture used is typical of those required for band machining. Hold-down elements are unnecessary as the work is clamped to the table by the downward cutting force of the blade. DoALL offers a complete band machine fixturing service and provides design sketches free of charge.

If you do production splitting and slotting, it will pay you to call your local DoALL Sales-Service for a free demonstration in your plant, or write:

THE DoALL COMPANY, Des Plaines, Illinois

DoALL

FREE LITERATURE AND MOVIES—The new 16-page saw band catalog and the new contour-matic catalog are now available as well as two sound-color movies for group showings—"Production Band Machining" (30 min.), and "Production Tooling" (10 min.).

Friendly DoALL Sales-Service Stores in 38 cities—call yours today!

PB-30

CIRCLE INFORM-A-GRAM KEY NO. 122

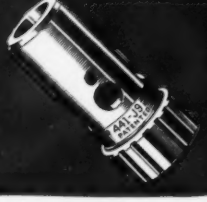
Jacobs
CHUCKS

Dependability is the sum of dependable parts.

Jacobs and your industrial supply distributor are ready to deliver the chucks you need and the service you deserve. First in chucks . . . first in service.

The Jacobs Manufacturing Company
West Hartford, Connecticut

The Jacobs Model 91 Spindle Nose Collet Chuck for tool room and engine lathes.



The Jacobs Rubber-Flex® Tap Chuck designed for tapping heads and impact tools.

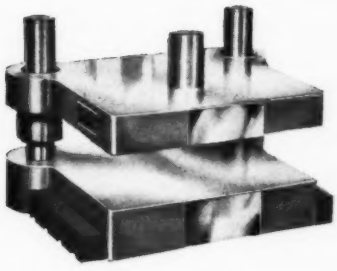
The Jacobs Plain Bearing Chuck for drill presses, portable electric and air tools.

The Jacobs Impact Keyless Chuck especially designed for the aircraft industry.

The Jacobs Model 96 Collet Chuck for grinding machines, millers and jig-borers.

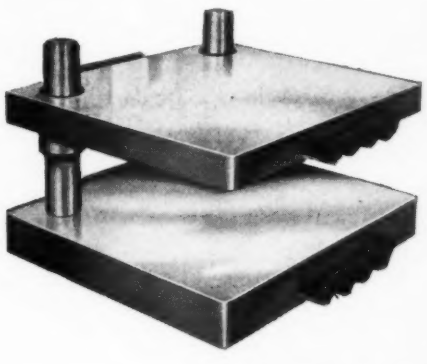
The Jacobs Ball Bearing Super Chuck for heavy duty and precision industrial use.

HANDLE LARGE AND SMALL DIE SETS SAFER-FASTER-MORE EFFICIENTLY



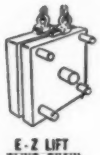
ONLY SUPERIOR *precision all steel*
DIE SETS *offer exclusive safety and handling features.*

Three features exclusive with SUPERIOR DIE SETS permit rapid assembly, disassembly and overall handling of large and small die sets. In addition they provide safety insurance . . . protection for the skilled hands of die makers and handlers . . . protection also against the ruining of costly dies in handling, or even damaging of valuable press equipment. **In addition, all Superior Die Sets are jig bored to your specifications — result number of sizes practically limitless.** Write for FREE 24 page Catalog on Superior Die Sets and Supplies.

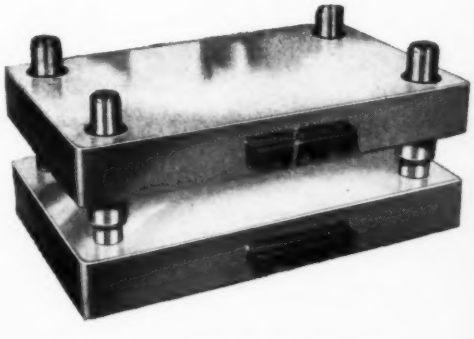


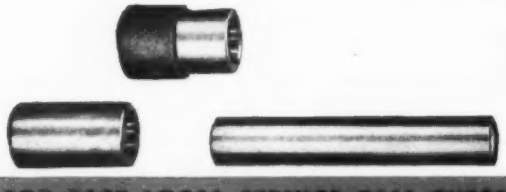
LOCK-JAW LIFTING DEVICE removes the danger of handling large die sets.

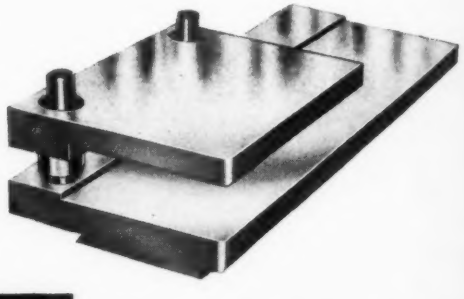
SAFETY FLANGE protects fingers by providing roomy gripping space on either side of the die shoe.



E-Z LIFT SLING CHAIN attach to the lock-jaw for immediate lifting.







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CIRCLE INFORM-A-GRAM KEY NO. 124

new

electro-ground

carbide end mills

manufactured by **ELGIN**

Elgin GOLDEN CIRCLE Carbide End Mills . . . solid carbide, of course, for the toughest jobs. But most important, Elgin Golden Circle End Mills are ground by Elgin's new Electro-Grind process which completely eliminates the strains and grinding checks caused by conventional methods. No chance for chipped or flaked cutting edges caused by high temperatures during grinding!

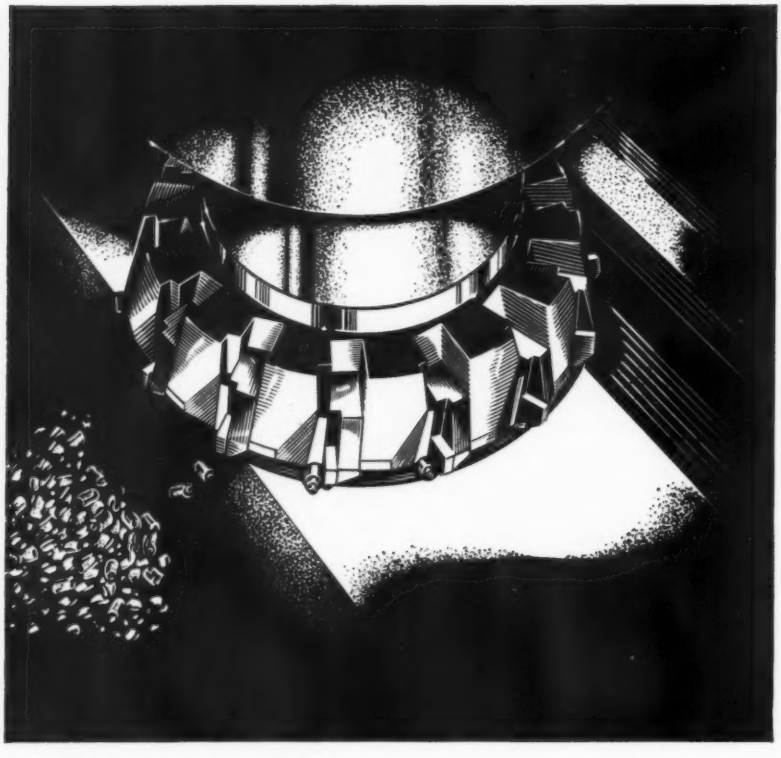
Electro-Grind combined with the use of extra fine grit wheels gives the sharpest, smoothest cutting edges yet—your assurance of the highest quality tools obtainable, increased production, less frequent regrinding, greater accuracy.

Write for new catalog showing complete line of solid carbide end mills, drills, reamers and burs—in stock for immediate delivery.

Abrasives Division

ELGIN NATIONAL WATCH COMPANY

ELGIN, ILLINOIS



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That's the inserted blade carbide tipped milling cutter. Here's a tool that really outperforms ordinary milling cutters when it's used right. It makes possible increased production with more pieces per grind and better finishes at lower cost.

Economical milling with carbides requires careful tool engineering. This has been recognized for many years at Go & Go. Failure to do so has soured many a carbide application.

Go & Go produces a complete line of inserted blade carbide milling cutters including tools designed for specific jobs (specials). We think they're the finest you can buy because sound engineering comes with these cutters. If your application isn't right for them, we'll tell you so. And we'll tell you how to make it right.

For specifications on a really complete line of inserted blade carbide milling cutters, ask for Catalog "F". Or better still, consult the Go & Go engineering sales representative in your area.

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GODDARD & GODDARD COMPANY
DETROIT 23, MICHIGAN
Engineering and producing tools that Go & Go since 1917.

CIRCLE INFORM-A-GRAM KEY NO. 126

APPLICATION GUIDES IN SPECIFYING STEELS

by Joseph Gurski
Assistant Manager
Manufacturing Research Department
FORD MOTOR COMPANY
Dearborn, Michigan

THE MAJOR REASON FOR THE DEVELOPMENT of any guide in specifying steels is to reduce costs. It can be done by the efficient utilization of materials through design, processing and standardization — by controlling specification of metallurgical requirements.

Such control becomes increasingly important, since changes in steel pricing in the last few years have added about 10 to 15% to the base price. The gains that can be achieved by standardization and simplification are well known. They can be applied to steel as well as to other materials and parts.

The responsibility for achieving the most efficient utilization of materials lies in two broad areas—product engineering and manufacturing. Product engineering is vitally concerned with adequate designs so that the part will do the required job. Manufacturing is concerned with the processing and with the possibilities of standardization so as to reduce costs in its area.

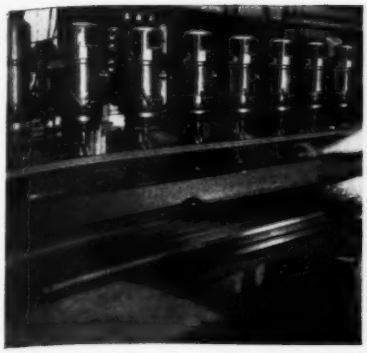
With steel prices up, savings must be realized by control of specifications, according to the author.

As a result of the more complicated parts we have today and the importance that is placed on processing cost, with resulting automation and more complicated machines, the problem of planning and timing assumes greater importance.

Since an order normally cannot be placed unless released drawings of the parts are available, it is obvious that product engineers' work must be completed by certain deadlines or "D" days. At some point prior to "D" day all debate must be terminated, decisions made and parts released. Up to "D" day effective liaison must be conducted between manufacturing and product engineering to make sure that released designs will reflect efficient utilization of materials.

Factors such as availability of equipment in the manufacturing facility must be weighed against the purchase of new equipment which would do a more effective job. Subsequent to "D" day, manufacturing

From a paper presented recently at the Seventh National Conference on Standards in New York City.



NEW Drill Set-Up Cuts 5-Day's Production to 5 Hours

Part of the production operation for the Western Patio Door Co., Berkley, California, is the drilling of eight holes in extruded aluminum sides for glass patio doors. By drilling one hole at a time and indexing the part eight times, 1200 pieces were produced in five eight-hour days. In an attempt to speed up this operation, and thereby cut costs, the set-up as shown was suggested.

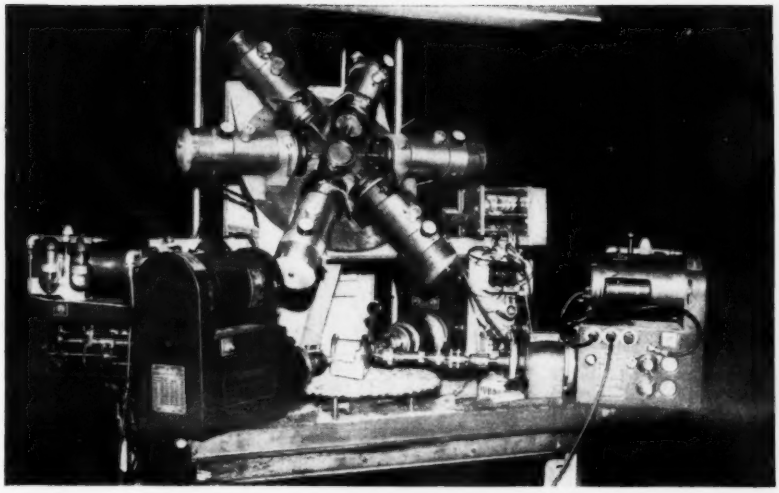
Set-Up

Now, the parts are fed to the operator on a slanted track-way under the new drilling machine. Pieces are then hand loaded and clamped into position. The operator actuates the machine by pressing one starter button. Eight heads with #38 drills then produce eight 3/16" blind holes in the part simultaneously in a matter of seconds.

This manufacturer now gets four of these parts drilled per minute. This includes loading, drilling, unloading and stacking finished parts. 1200 sides are completed in five hours, whereas it formerly required five eight-hour days. The time savings resulted in a substantial reduction in the production costs on this operation.

Drill Head Type

The drill head used for this unique machine is the Dumore Series 20 Automatic Drill Head. It utilizes the "resistance drilling" technique which permits the workpiece to determine the rate of drill feed and speed. Built-in controls practically eliminate drill breakage and scrap losses. It automatically maintains the correct feed pressure, pre-selected drilling depth accurate to .004" and the right drill speed for type of work. This compact, easy to mount tool is ideal for high production drilling of small parts. No. 80 to 5/32" drill capacity. For further information on this and other Dumore precision tools, write to The Dumore Company, 1304 Seventeenth Street, Racine, Wisconsin. Adv.



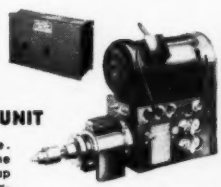
Standard DUMORE Components Make Special Production Machines . . .

for Quick, Low-Cost AUTOMATION

Presto Line Corp., Los Angeles, uses three types of Dumore standard components. These inexpensive precision tools are easily arranged in the set-up as shown. On it, zinc die castings are recessed, tapped and drilled in one continuous operation handled by one man. From 260 to 300 pieces per hour flow through this set-up with *no scrap losses.*

Two Dumore Series 24 Units are mounted on the work table with simple standard nose brackets, one on the right corner and the other opposite. These recess both ends of castings simultaneously. On the other two corners are two Dumore Series 28 Units which tap both ends simultaneously, after castings index automatically from recessing position. The operator then places the workpieces on the fixture above, consisting of six Dumore Series 20 Units which drill six 3/32" holes at once.

By using Dumore standard components, this manufacturer gained quick, precision automation at low initial machine cost.



NEW Series 28 AUTOMATIC "DRILL-N-TAP" UNIT

Two tools in one. Drills or taps at the flip of a switch. Tap fits into chuck, no extra head required. For long or short runs. Reversing motor removes tap, eliminates expensive clutches. Spindle speeds 265 to 4900 rpm. Mounts anywhere with simple nose bracket attachment.

Series 24 AUTOMATIC DRILL UNIT

All controls built-in. For production runs with varying conditions and frequent changeovers — single or multi-unit operations. Variable speeds, feeds, depths. Nose mounting bracket, Hydraulic Feed Control and chip breaking accessories available.

Series 20 AUTOMATIC DRILL HEAD

Economical, dependable unit for small parts drilling. Built-in controls. No. 80 to 5/32" drill capacity.

Get the facts on how Dumore automatic standard components can give you low cost precision automation for your work. Ask your distributor for details, or write . . .

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TOOL POST and
HAND GRINDERS

CIRCLE INFORM-A-GRAM KEY NO. 127

MOLINE
No. 13CB V-type cylinder boring unit is used either as an individual machine or as one of several automated units in a transfer line for boring automotive engine cylinders.
MR138 four-way, hydraulic feed, drilling, boring and facing machine with hydraulic clamping fixture for tractor main frame housings.
For Greater
PRODUCTION . . . EFFICIENCY . . . SAVINGS
Use an individually designed "Hole-Hog" Machine Tool for such jobs as...
Multi-Spindle Boring
Single and Multi-Spindle Honing
Straight Line Multi-Drilling
Adjustable Spindle Drilling
Vertical and Way-Type Fixed Center Drilling, Boring and Tapping
Special Multiple Operation Machine Tools
OVER 55 YEARS OF MACHINE TOOL ENGINEERING EXPERIENCE IS AT YOUR SERVICE. TELL US YOUR PARTICULAR PROBLEM
106
HD67 hydraulic rail feed, straight-line type, multi-spindle drilling machine. Six-foot rail length as shown; also available in eight and ten-foot lengths.
No. 116-U hydraulic rail feed, universal joint type driller with 16 two-speed and neutral top drivers plus four-speed quick change gear box. Spindles illustrated are 1½" drill capacity each in mild steel.
MOLINE TOOL CO. HOLE-HOG MOLINE, ILLINOIS
MOLINE TOOL COMPANY
REPRESENTATIVES IN PRINCIPAL CITIES
100 20TH STREET · MOLINE, ILLINOIS
CIRCLE INFORM-A-GRAM KEY NO. 128

must keep vigilant for later technological changes which, if important enough, might still be incorporated.

In view of the necessity of releasing designs considerably ahead of production deadlines, and the obviously desirable goal of releasing designs which are correct in all respects and require no changing or deviation during the life of the model, it appears that the following basic operating principle for product engineering drawings would be desirable:

Allow manufacturing all possible freedom in selecting materials and processes consistent with production of parts that satisfy end product requirements.

Recognizing this situation, Ford Motor Company materials engineers specify materials and processes in such a way as to allow manufacturing departments this leeway. Their thinking is that you cannot tell a manufacturer what you want in a finished part and tell him how to do the job, too. If you insist on telling him how to do the job you must be ready to accept the results of that process. Obviously the best procedure is to specify the desired attributes and permit latitude in materials and processing.

Bolt and Stud Standards

One device used at Ford to stabilize engineering drawings is the M-3500 Bolt and Stud Standard. This standard designates the minimum physical requirements for various grades from M-3500-A through M-3500-H. Then a section of the standard lists the steels that are permitted for the various grades. For instance:

Grade	Steel
M-3500-A	AISI C-1013, SAE-1015, 1016, 1017, 1018, 1019, 1020 or 1022.
M-3500-G	Alloy steel of 0.30-.45 carbon with sufficient hardenability to obtain a minimum "as quenched" hardness of Rockwell C45 at the center of the threaded portion of the bolt after oil quenching.

Specifying a bolt by M-3500-A permits each supplier to standardize on the material which is best suited to his process.

In our own practice, we were able to develop a metal specification calling for a coiled 0.218" dia hot rolled AISI C-1013 steel wire which was made ultimately into 35 production bolts and nine service bolts. This hot-rolled wire was cold reduced in our shop, as needed, to nine sizes ranging from 0.085" to 0.192". All 44 bolts were then made from these nine sizes. The important fact here is that we bought only one hot rolled size to make all these bolts. It can be seen that if individual steels had been specified for this number of bolts, there undoubtedly would have

Talking About Die Sets

with
Phil Marsillus
Vice-President
The Producto Machine Co.

Master or Commercial: What Makes the Difference? The most obvious difference between a Master (Precision) set and a Commercial set is the price. The Commercial set costs less because less assembly time is required in its manufacture. Punch holder and die holder tolerances are the same for both grades of die set. However, extremely close tolerances for fit between pins and bushings on Master sets require more accurate honing of bushings in assembly. Master die set tolerances for parallelism between punch and die holder are also more critical than those for Commercial die sets.

Normally, the difference between pin and bushing diameters on die sets manufactured by our industry is never less than .0002" and ranges as high as .0009". There are die sets made to closer or looser tolerances than these, but generally speaking, the majority of die sets fall into this category.

Master die sets are manufactured to the low side of this tolerance scale and are held to a maximum of .0004" differential. This closer tolerance increases the useful life of precision sets by allowing for wearing of the pins and bushings in operation.

Commercial die sets are made throughout the entire range of this tolerance scale and, more often than not (to reduce assembly cost), are made to the higher tolerances. As a result, their accuracy will usually decrease much faster than that of Master die sets. While it is possible with this tolerance range to receive a Commercial set with the minimum pin and bushing fit allowed, you can be certain of longer die set accuracy only with a Master set, which is guaranteed to be held to the low side.

A "free-sliding fit" is one that permits the punch holder to move down on the guide pins of its own weight. It does not have any bearing on the degree of accuracy of the die set since a free-sliding fit can be supplied on both Master and Commercial sets. On Master sets, however, it is sometimes necessary to hone out the bushings to a full .0004" tolerance to provide a free-sliding fit.

EVERY die set MUST, of necessity, work freely in normal use, *on the press,* but catalog die sets should come apart and go together easily for bench work. With an occasional exception (when sets are made to the lowest tolerance for fit allowed), disassembly should be possible by hand without use of separating tools.

In making a choice, the degree of accuracy required and the life requirements of the die set should be the main points of consideration which determine whether you should order a Master or Commercial die set.

IT'S HERE!

A new catalog designed for you!

WRITE FOR YOUR COPY TODAY

Here, at last, is a die set catalog that makes your selection and ordering really easy. Producto's all-new catalog is compact for the die designer, convenient for the purchasing agent, a functional tool for the die maker.

These unique features make Producto's catalog much easier for you to use:

IT'S COMPACT. Though many items have been added, it has *fewer* pages because superfluous material has been eliminated. New products include Qwik-Fit Guide Pins, new Bushings with grease fittings, Lamina Bushings, Ring Punches and Dies, Toolroom Equipment, Lubrication Accessories and new Die Spring Selections.

IT'S COMPLETE, containing the greatest selection of die sets and accessories that has ever been offered to date.

ALL PRICES ARE NET and appear in a *separate pricing supplement,* removed from the technical section. No more time-consuming "discount" calculations.

NEW BINDING ARRANGEMENT lets you look at technical and pricing information *simultaneously.* No more flipping pages back and forth to get complete information.

STREAMLINED PAGE LAYOUT makes it easier for you to find essential data. Color highlights catalog numbers and drawings.

To make your die set ordering as painless as possible, write today for a free copy of Producto's new Catalog No. 11.

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970 Housatonic Avenue, Bridgeport 1, Connecticut

Wherever die sets are used

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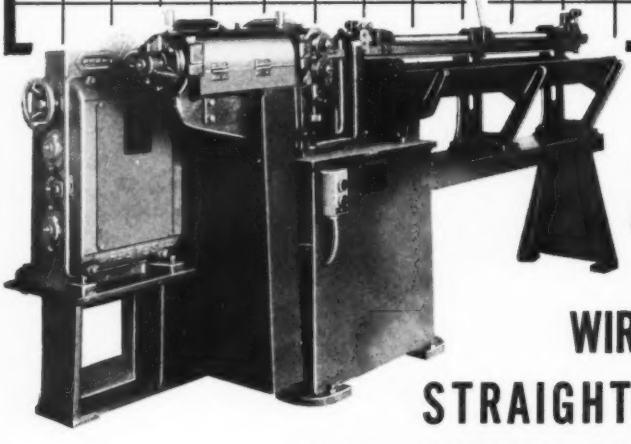
SHUSTER
LIGHTNING CUT-OFF
PRODUCTION BOOSTER



1 AV
WIRE STRAIGHTENING AND CUTTING MACHINE

DESIGN ADVANTAGES

Micro-switch target and clutch

Lightning cut-off

Hardened steel cut-off knife delivers square, true, undistorted ends.

Direct-drive five-die straightening flier

Ball and roller bearings throughout

Other infinite variable speed machines for diameters up to 11/16" are available. Send for literature.

NOW EQUIPPED WITH ELECTRICALLY CONTROLLED TARGET AND CLUTCH!

Variable Speed — the speed you want when you want it. Geared to feed 50 to 200 feet per minute.

Constant Speed when set, regardless of load variations!

Infinite feed changes and control!

Minimum maintenance — frees operator from worry!

Straightens and cuts 3/32" to 1/4" **or** 1/16" to 3/16" diameter basic wire — real production flexibility!

Most economical machine of its kind! — both in original cost and maintenance!

Send for Bulletin No. 53

METTLER MACHINE TOOL, INC.

150 Adeline St. **New Haven, Conn.**

CIRCLE INFORM-A-GRAM KEY NO. 130

been at least six different steels called for.

Carbon Steel Substitution

Another device used to stabilize engineering drawings is Ford's Recommended Practice Specification M-2K2 for the selection of carbon steels. Excerpts from the specifications illustrate how it works:

- The Scope states, "This specification is intended to permit the widest latitude for manufacturing consistent with engineering and drawing and requirements."
- The Requirements recognize that different steels will give physical characteristics that are equal to or better than those specified. It also recognizes that free cutting steel can be used instead of conventional steels.
- Another section indicates that listing steels as options shall be construed as to guarantee that they all can be fitted into a particular process. *Proper processing is the responsibility of the supplier.*

It works this way. The material specification calls for SAE 1020 (M-2K2-E) steel. Referring to our substitution chart in Specification M-2K2, we see that SAE-1020 (M-2K2-E) steel permits the use of AISI C-1023, SAE-1020, 1025, 1027, 1030, 1033, 1035, or M-2K2-F through K steels.

In the M-2K2-F through K groups we find that there are 29 additional grades permitted. With all these options it can readily be seen that manufacturing should not have to bother engineering for a deviation from metal specifications or wait 60 days for a change in the blueprint.

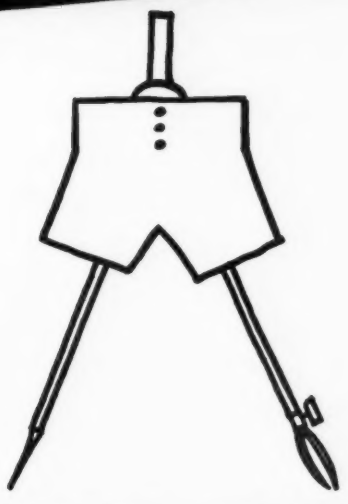
Metal Specifications in Manufacturing

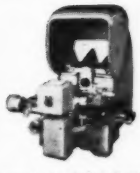
From here, manufacturing takes over, and since drawings do not specify detail material requirements, we must provide another means of recording raw material requirements. We do this through a piece of paper called a "metal specification." Details such as sizes, tolerances, shipping instructions, packaging information and pertinent metallurgical data are included. These data are used also as purchasing authority when requisitions are issued.

Examination of the specification discloses additional reasons why it is undesirable for engineering to specify too much detail. Metallurgical activities coordinating with process engineers have reviewed the processing of the part. It had been decided that the part should be produced on an automatic screw machine so that a free cutting steel, SAE 1119, was selected from among the permitted options of M-2K2-E. Note that hot rolled steel is used instead of cold drawn, that a silicon of .10 maximum is specified, and that special bar quality is called for. It was also decided that the steel had to be pickled and machine straightened.

DROODLES

by ROGER PRICE





Bench Model BC-7D

Floor Model FC-30

Floor Model FC-14

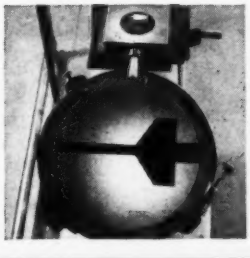
Table Model TC-14
(Vertical Inspection)

"WELL-DRESSED COMPASS"

This delightful Droodle was inspired by an old photo of my Uncle Fred, showing him all togged out and rarin' to go in the 1924 Olympics in Constantinople. This disconcerted everybody, because the Olympic Games were being held in Paris. The explanation was that Fred had overdone things at a bon-voyage party with friends, and was tossed onto the wrong ship. Furious with embarrassment, he embarked on an epic binge involving pizza and beer. This barred him from the hop-skip-and-jump event, of course. But by exerting a little pull he wangled his way onto the tug-of-war team and heaved his way to a glorious victory.

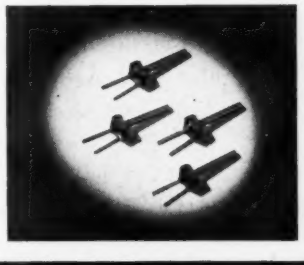
While we're chatting here, I'd like to give you a few facts about the Jones & Lamson Optical Comparator, which can help you set new records for inspection efficiency. This marvelous instrument measures and inspects all sorts of work pieces and components, in a variety of sizes and shapes. The J & L Comparator is rapid, and accurate to .0001"; and it's so flexible, you'll be able to perform inspections that just aren't possible by any other method. Available in eleven different models, both bench and pedestal types. Write Dept. 710 today for complete information.

JONES & LAMSON OPTICAL COMPARATORS *On the Job . . .*



at Commercial Centerless Grinding Co., Cleveland, Ohio

This company, a well-known manufacturer of precision instrument parts, has been using J & L Comparators for years, to insure top quality control. A typical inspection piece is this valve pin, 3/16" hex., #416 stainless steel, which is rapidly and accurately inspected after each grinding operation, and then checked out after final grinding.



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BRANCH OFFICES IN DAYTON, OHIO, WASHINGTON, D. C. and TORONTO, ONT., CAN.

CIRCLE INFORM-A-GRAM KEY NO. 132

At the time the drawing was made no one knew exactly how this part was to be made, so it would have been impossible to specify this detail.

The details mentioned are those that affect the cost of steel. *If one over-specifies then one pays for properties that yield no benefit as far as the end product is concerned.* Improper specifications can result in unnecessary payments of many thousands of dollars.

The decisions made in the following case histories could easily have been in the direction of higher cost. Once specifications are written, the steel is purchased and processed. Without close control, costs incurred are assumed necessary and it could be a long time before anyone questioned them.

Blueprints of rear spring leaves specified that the raw material, SAE-5160 steel, must have a maximum hardness of 300 Brinell to insure that the steel can be blanked. Review indicated that if we had specified this hardness we would have had to pay a premium of $330,000 annually because of the large amount of steel that was required for springs. A close study of price—extra books revealed that we could take a calculated risk and specify "suitable for cold shearing and punching as outlined in steel products manual No. 10," thus not calling for a specific hardness.

A transmission gear was being machined from hot rolled alloy steel bar that was pickled, oiled and machine straightened. Investigation revealed that the machine straightening operation removed a good deal of the scale. A calculated risk was taken and the P. and O. requirement was removed. This resulted in a $.45 per cwt saving, or an annual saving of $24,300.

Piston pin raw material was revised from tubing to bar stock. Because of the closeness of the raw material size to the finished diameter, a "piston pin quality" was required. By reviewing the part processing we removed the piston pin quality requirement, specified magnetic testing, increased the ordering size 0.010", took a slight calculated risk that we would machine off any surface imperfections, and saved $50,400 annually.

The requirements for a frame reinforcing plate were reviewed. Again, by taking a slight calculated risk we reduced our "special bar quality" to "merchant bar quality" and saved $8,500 per year.

The field of cost reduction is very fertile. Today the extras charged for all kinds of metallurgical requirements make mandatory a close look at all prices. It is costly to pay for requirements which add absolutely nothing to the end product. *Today, more than ever before, one must be a "dollar metallurgist."*

... Continued on page 140

CUT COSTS

with the Original Mead MIDGET AIR CLAMP

(Spring Return Air Cylinder)

In assembly jigs and other multiple applications, this new, low cost pressure unit saves countless man-hours. As a work-ejector in many fixtures, it is unexcelled.

Advantages over mechanical clamps

1 **All Air Clamps** in any set-up can be operated by a single master valve—the "lock-up" and release of assemblies is instantaneous.

2 **May be installed in cramped corners** difficult to reach with bulky mechanical clamps. Mead Midget is the most compact air cylinder, for its power, on the market.

3 **Equal ram pressure at any point** along stroke, making special, delicate adjustments unnecessary.

4 **Independent group control.** Any desired group of "Midgets" can be controlled independently of any other group in an assembly—as where primary members of the fixture must be locked up before the secondary members.

5 **Facilitates delicate drill operations.** Air Clamps actuated by foot control valves leave operator's hands free to handle the work pieces.

Send for all the interesting facts on these time-tested, superior Midget Air Clamps.

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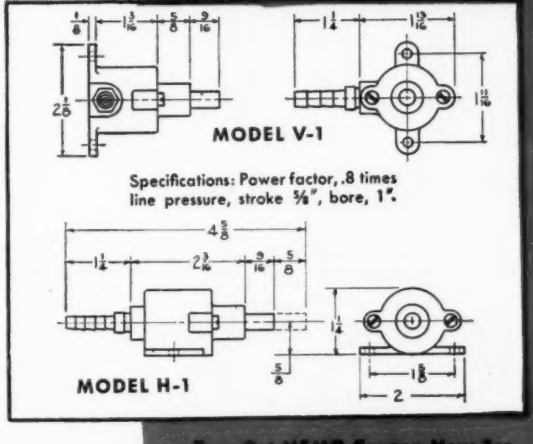

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Single-acting cylinders delivered from stock; double-acting in a few days.

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***New* MEAD INDUSTRIAL AIR POWER CATALOG**

Full of suggestions for faster, cheaper production with famous MEAD AIR-POWERED Cylinders, Valves, Presses, Vises, Chucks, Hammers, Drill Press Feeds, Work Feeders, semi-automatic combinations, etc. Send today.

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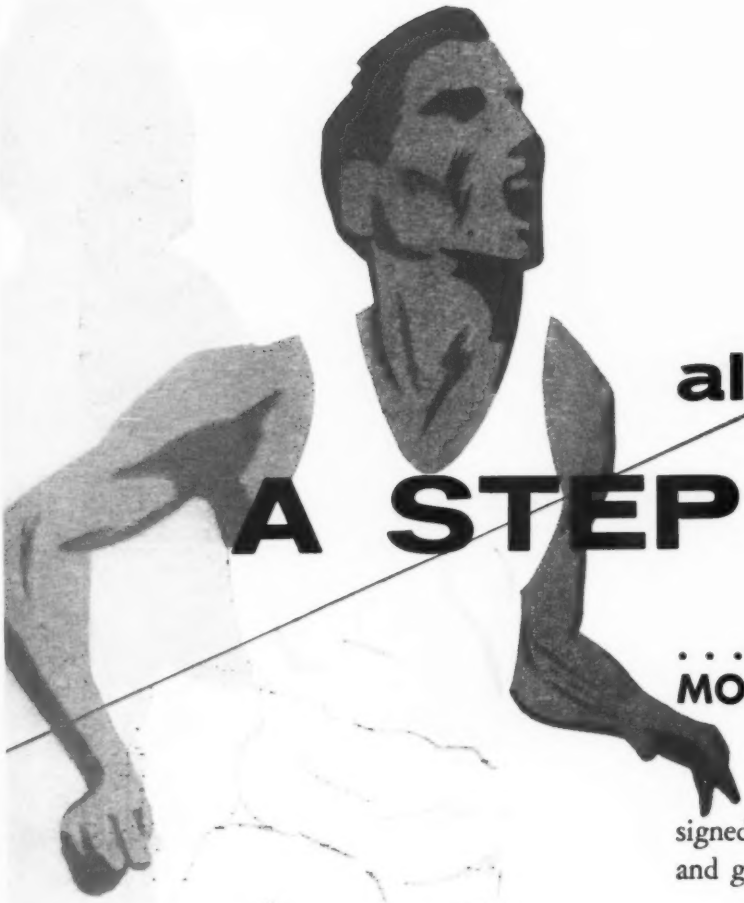

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Boyar-Schultz Screw Machine Tools are designed and developed to fill the need for finer quality and greater production in the screw machine shop.

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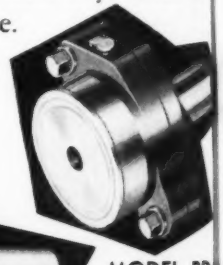

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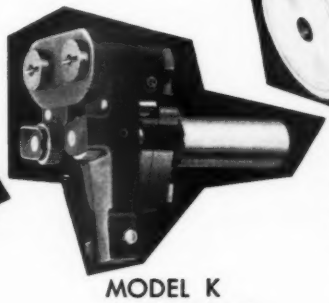
Deep Hole
Drilling Tool



MODEL K
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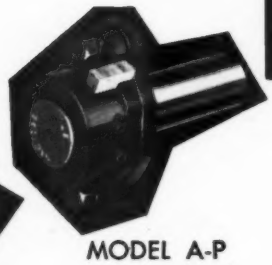

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Why the trend to heat-treated cap screws in the heavy equipment industry?

Chicago Screw engineers worked with leading manufacturers to develop the high-strength, heat-treated screws that take more punishment and greatly reduce fastener costs

Strength, and the ability to withstand severe punishment, are prime requirements for fasteners used in heavy equipment. As a leading fastener source for most of the top manufacturers of heavy equipment, CHICAGO SCREW conducts a thorough research and development program aimed at steadily improving fastener performance.

A major result of this program is the development of the CHICAGO *carbon-restored* heat-treated cap screw, now replacing bright-finish fasteners for most heavy equipment applications. Design engineers have found the far greater tensile strength of the heat-treated fastener (see chart) gives a better fastening with fewer—or smaller—screws. This means less weight . . . and a considerable reduction in fastener costs.

In addition to greater strength, CHICAGO heat-treated cap screws prove far superior in withstanding fatigue, wear, shock and vibration. This is because a major cause of fastener failure—a surface layer of soft, decarburized steel—is eliminated by our unique Carbon Restoration process. Vital surface carbon is restored in a scientifically controlled process during final heat-treating, producing a fastener that's uniformly hard from core to surface.

Our engineers will be glad to advise you on designing to best take advantage of heat-treated cap screws. For complete information on cost savings you can get in your products . . . and a detailed version of the condensed tensile strength chart at right . . . drop a line to our Standard Products Division.

HOW TENSILE STRENGTH COMPARES

Diameter (Coarse Thread)	Bright Cap Screws Tensile Strength (Pounds)	Heat-Treated Cap Screws SAE Grade 5 Tensile Strength (Pounds)
¼	2,150	3,810
5/16	3,550	6,270
3/8	5,250	9,280
7/16	7,200	12,720
½	9,650	17,000
9/16	12,400	21,800
⅝	15,400	27,070
¾	21,400	40,100
⅞	29,500	53,040
1	38,700	69,590

THE CHICAGO SCREW COMPANY

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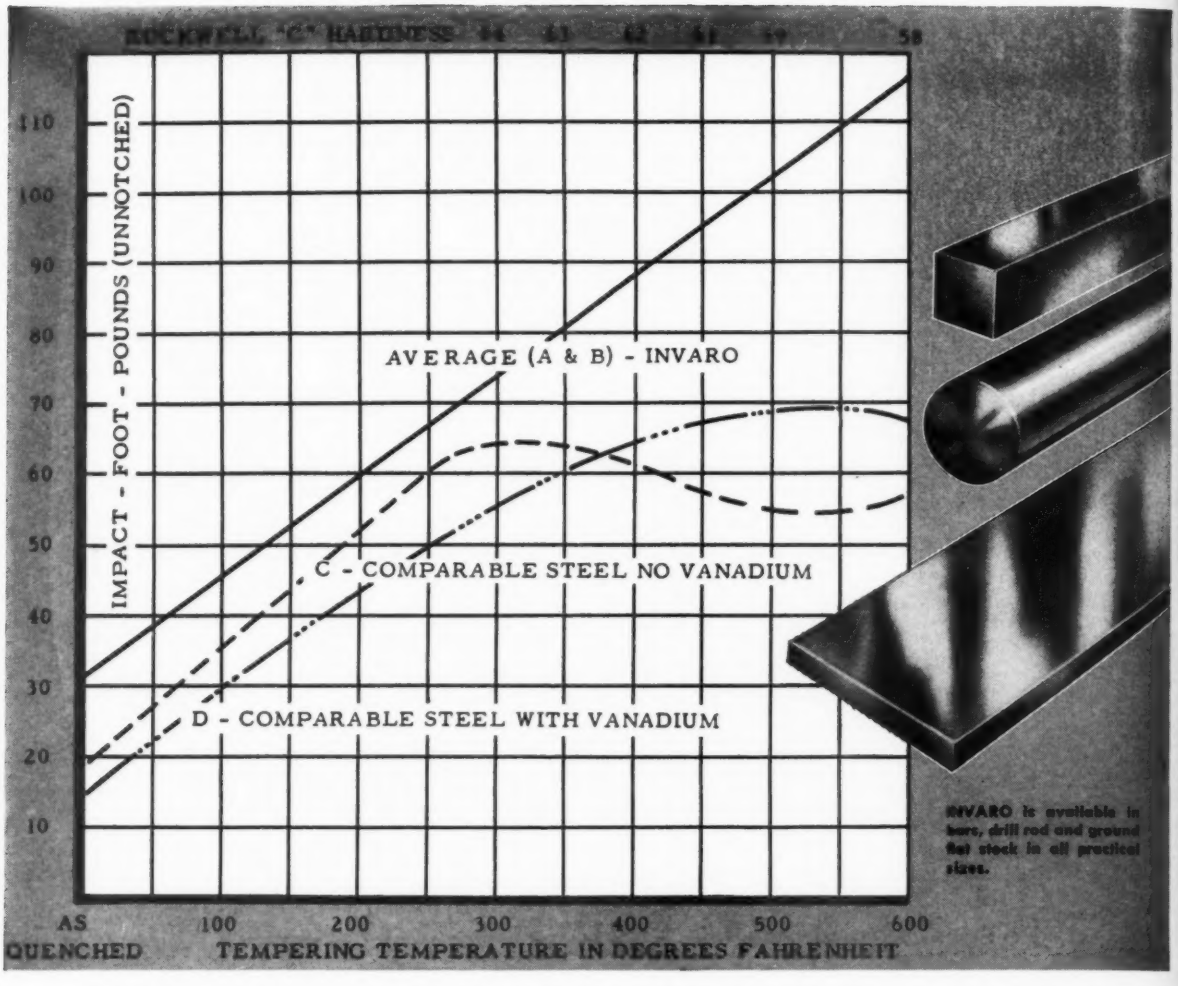

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of leading comparable oil-hardening tool and die steels

When the toughness of a tool and die steel is the critical factor of selection, Firth Sterling INVARO is the *toughest* of the tough! That's not just an opinion but a *fact.* Undeniable proof is established by the A.S.T.M. Izod Impact Test, results of which are graphically shown above, comparing steels both with and without vanadium.

INVARO shows a superior toughness in *all* ranges of temperature from a minimum advantage of about 12% to as much as 100% greater! This marked superiority is the result of Firth Sterling's advanced metallurgical practices combined with 67 years of experience in the art of making specialty steels.

Yes, when you want *toughness* in your tools and dies, combined with uniformity, excellent hardening properties and safety in heat treating . . . specify INVARO.

Chemical Analysis	*All test samples were machined from half-inch annealed bar stock.*							
	C	Si	Mn	S	P	W	V	Cr
Invaro A	.88	.34	1.22	.010	.020	.49	.19	.50
Invaro B	.94	.25	1.20	.014	.013	.53	.22	.49
Comp. C	.90	.33	1.24	.011	.025	.50	—	.55
Comp. D	.95	.34	1.27	.010	.020	.50	.21	.59

Firth Sterling

—INC—

R-320

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Sintered Tungsten Carbides
Firth Heavy Metal
Chromium Carbides
High Temperature Cermets
Zirconium

Rake, or hook (curved rake), is an all important element in the cutting ability of a tap tooth. The angle required to cut tool steel will not do the same job on cast iron, or brass, or aluminum. For every material there is a best rake or hook angle.

Whether they are stock taps with standard rake or hook for general purpose tapping; special purpose stock taps for a specific material; or special taps, cutting angle could mean success or failure on the job.

"Greenfield's" quality control includes checking this vital element on equipment especially designed for the purpose.

GREENFIELD TAP and DIE CORP.
GREENFIELD, MASS.

Photo courtesy of The Lodge & Shipley Company

THE LATHE — *Lodge & Shipley 16" Power-Turn 90° Copymatic Lathe*

THE OPERATION — *Turning and facing to close tolerances*

THE CHUCK — *Horton, of course*

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Greenfield Tap and Die Corporation
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to many a design problem

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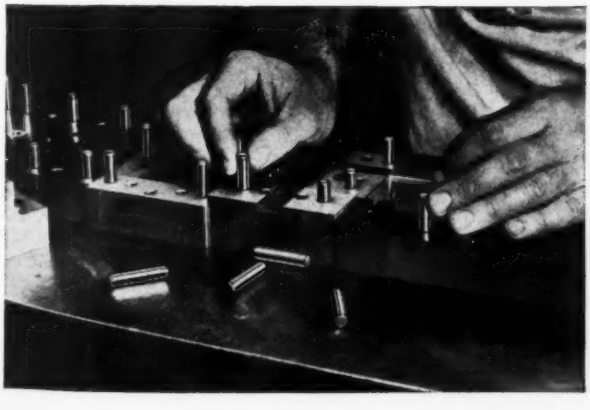
ALLEN DOWEL PINS are being profitably employed in a thousand and one ingenious ways beyond their conventional applications in tool and die work — as economical roller bearings, as axles, precision plugs, hinges and wrist pins to name a few.

If you have an application that will utilize the great strength, accuracy and fine finish of Allen Dowel Pins, you can save substantially on the cost of your product — because you can secure them at favorable prices right from your Allen Distributor's stock.

Check the quick facts at the right and write directly to Allen's Engineering Department for further technical information.



SPECIFICATIONS

- Made from Allenoy heat treated steel. Surface hardness 62-64, Rockwell C scale; core hardness 52-54. Case depth .010" to .020" depending on size.
- Single shear strength 160,000 to 180,000 p.s.i.
- Surfaces precision ground to ± .0001" with micro-inch finish of 6 RMS max.
- Sizes: Diameters, ⅛" to 1". Lengths, ⅜" to 6".
- Two standard oversizes — .0002 for press fits between mating parts, or .001 for repair work, or holes machined oversize.

ALLEN HEAD

ALLEN
MANUFACTURING COMPANY
Hartford 2, Connecticut, U.S.A.

CIRCLE INFORM-A-GRAM KEY NO. 139

STANDARDIZED AUTOMATION!

Standard 12 stop Intermittor with specially jig-bored 36" dial.

PRECISION INDEX TABLES FOR HIGH SPEED PRODUCTION

CAN YOUR PRESENT MACHINERY PRODUCE 30,000 PIECES AN HOUR?

Few production machines can . . . but it's possible with the Ferguson Intermittor Index Table. There are models capable of 30,000 indexes an hour if your machinery and tooling can keep up with them. The point is . . . *the Intermittor does not limit the speed of your machinery the way geneva driven or air or hydraulic operated tables do.*

Perhaps speed is not your problem, but excessive maintenance costs are . . . resulting from the clanging, banging and jarring you get from a geneva drive. Here again you find the solution in an Intermittor. Employing modified trapizoid acceleration characteristics, the Intermittor has an initial acceleration point of zero with a gradual increase to the maximum and an equally gradual decrease to zero again . . . *all of which means that the Intermittor is a smooth operating table with minimum shock and vibration.*

Or maybe you like accuracy . . . but don't like shot pins. The Intermittor Indexing mechanism has an accuracy of .001" with zero backlash — *and no shot pins!*

There are many more reasons why you should install an Intermittor when you need a rotary table for large volume production, including the fact that you can select one of 150 standard models from a catalog and get exactly what you need in terms of dial size, number of stations and indexing period.

OVER 150 STANDARD MODELS TO CHOOSE FROM:

Standard 24 station Intermittor with 30" dial and optional stationary tooling plate above the dial.

6 station Intermittor with 12" dial and special tool mounting brackets.

Standard 18 station Intermittor with 48" dial.

Send for our Catalog No. 300 . . . it has a definite place in your file if you have the responsibility of speeding up production or converting to automation.

ferguson

FERGUSON MACHINE CORPORATION

ROLLER GEAR DIVISION, DEPT. HI-2 P. O. BOX 5841, ST. LOUIS 21, MO.

CIRCLE INFORM-A-GRAM KEY NO. 140

. . . Guides from Page 132

Preferred Sizes of Flat Metals

Preferred sizes of flat metals are used by our engineering departments as a standardizing medium. For years industry has been laboring under the handicap of numerous gage systems which differed from each other. Specifying a thickness by gage alone is a constant source of confusion, and it has become necessary to specify the decimal thickness in addition to the gage number. Accordingly, when the American standard became available, we felt it to be a very desirable step to adopt the use of this standard.

Many activities of our company have benefited from this simplification. Engineering departments, for example, have found it unnecessary to refer to different handbooks in order to determine gages available and the decimal sizes of such gages. Our engineering drawings used to spell out "No. 20 MS gage (.0359")." Now they say ".036" thick". When you consider the magnitude of our operations, the mere writing of such information on 25,000 drawings a year is worth something.

The savings in engineering departments are relatively small, but since basically they decide what manufacturing is to buy, their effective use of such a standard is all-important.

The use of preferred sizes in ordering flat metals has reduced the number of ordering sizes by permitting Ford to group "like" thicknesses. The reduction in ordering sizes by combining sizes, in 1956 in one department, necessitated the placing of fewer orders and resulted in a yearly saving of more than $327,000.

In another instance, 50,000 lbs of sheet stock was purchased at the mill for 5.3 cents per lb. A total of 30,500 lbs of strip stock was purchased at the warehouse for 8.5 cents per lb. Combining these orders and purchasing this 30,500 lbs in the wide sheet at 5.3 cents saved $11,712 annually. This savings more than offset the cost of shearing to the required size strips.

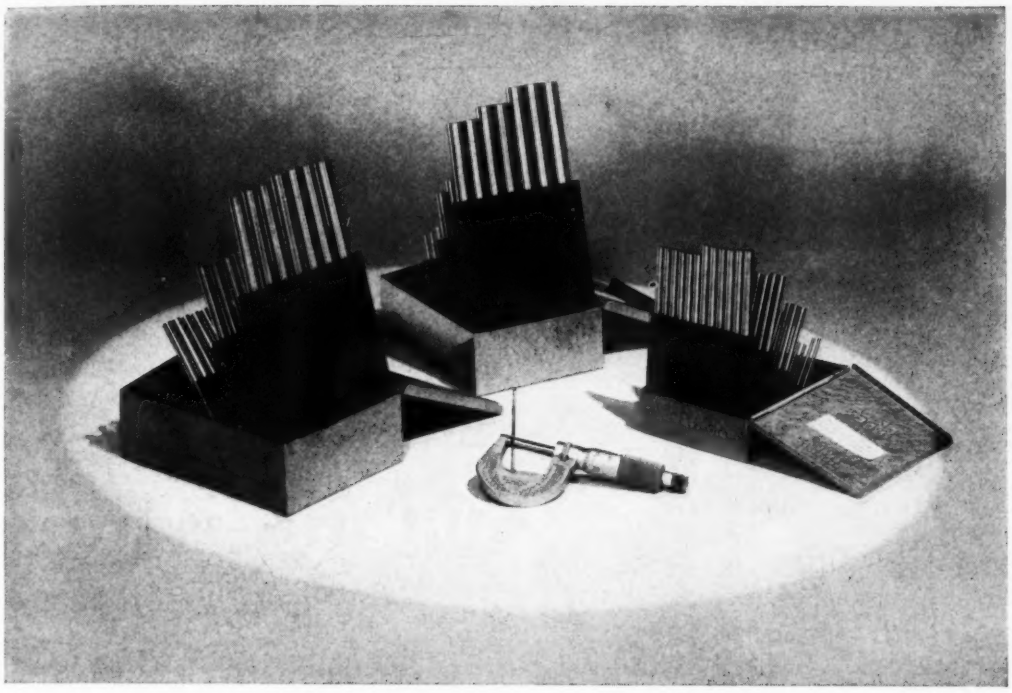
Efficient utilization of materials has many facets. Some areas where it would be profitable to look have been pinpointed here. Those individuals responsible for effecting such programs must consider the whole picture in their efforts. The tendency in engineering is to operate in familiar areas and copy those specifications that have been in existence for some time. The tendency in manufacturing is to subordinate materials savings if such materials require that more attention be given to processing. However, in both cases savings can be effected at very little risk.

In spite of all the problems associated with initiating standardization and simplification programs, the results are well worth the effort.

DRexel 6-4222 ESTABLISHED 1927

WILLIAM T. HUTCHINSON CO.
53 BROWN AVENUE SPRINGFIELD, NEW JERSEY

HUTCHINSON HSS BLANKS



115 Pieces – COMPLETE – .040" to .500" – $88.00

your choice of two tolerances
+ .0002" — .0000
or
+ .0000 — .0002"

JOBBER SET	LETTER SET	WIRE SET
$32.27	$29.03	$27.40
in Huot Index	in Huot Index	in Huot Index

HIGH SPEED STEEL — 64 "C" scale hard — gage tolerance — mirror finish. parallel ground

ANY DECIMAL DIAMETER OF STANDARD LENGTH .020" TO 1.000" SHIPPED ON 24 HOUR NOTICE

CIRCLE INFORM-A-GRAM KEY NO. 141

still the winner

... and in high speed steels, nothing beats REX

The winner and still champion after fifty years is Crucible's REX high speed steel. *And now it's better than ever!* Recent improvements in manufacturing processes have given even higher quality and greater uniformity to every one of its properties.

Why not shop test the new REX yourself? Test it for size, structure, response to heat treatment, fine tool performance. Give it any test you wish. You'll see why it is today, as it has always been — *the standard by which all other high speed steels are compared.*

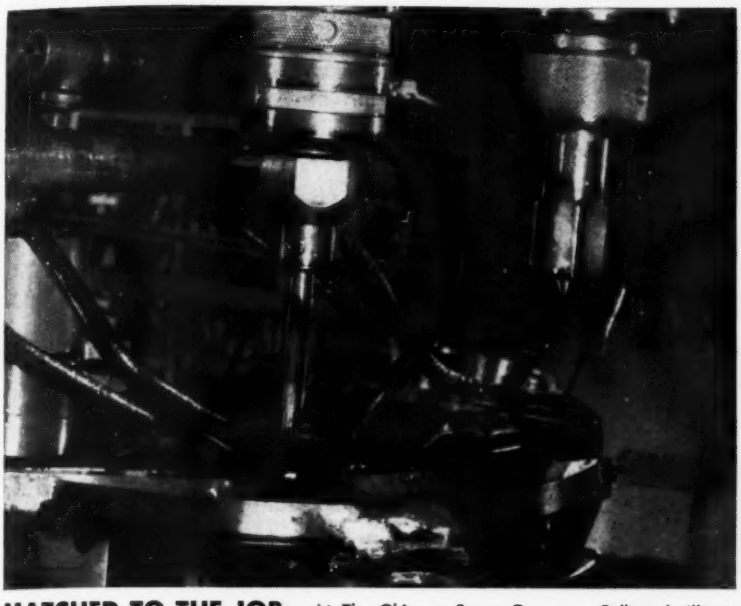
Ask for REX by name at your local Crucible warehouse. Or order it directly for prompt mill delivery. And for information on REX, and the other Crucible special purpose steels, send for the *Crucible Publication Catalog. Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

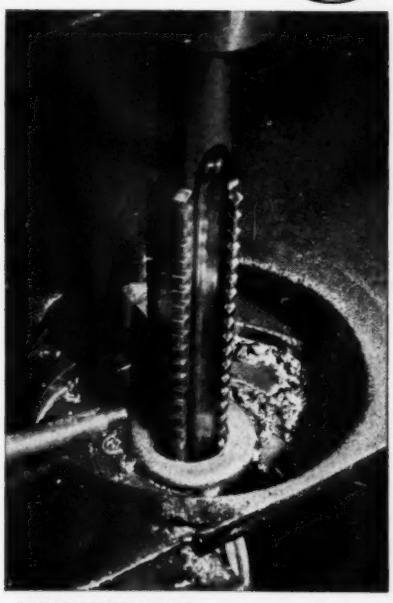
Crucible Steel Company of America

CIRCLE INFORM-A-GRAM KEY NO. 142

Cutting Tool and Gaging Methods . . . by BESLY

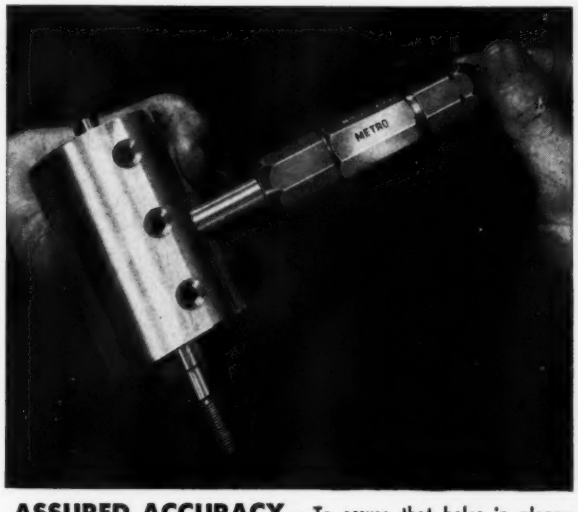


MATCHED TO THE JOB — At The Chicago Screw Company, Bellwood, Illinois, two sizes of Besly taps, poised above an indexing table, are ready to tap C-1141 steel parts. Operating alternately, the smaller 3/8"-24 Besly tap quickly threads a hole, then the work indexes beneath the 1 5/32"-24 Besly tap and a larger hole is threaded. By using Besly's Engineering Service, this company realized lower costs and a better job. The right taps were carefully selected and matched to the specific threading requirements.



SQUARED OFF — Templeton, Kenly & Company, Broadview, Ill. cuts heavy, almost square threads in malleable iron bases of rugged 12 to 24-ton screw jacks with Besly acme thread form Taps. Notice mirror finish on flutes promoting greater chip clearance.

TOUGH GOING — Here you see a C-1018 high carbon steel nut being threaded by a Besly 1 3/4" tap. Extremely abrasive, because it has been carburized and heat treated, the material is difficult to tap. However, Besly taps tested on the work, proved they could "take it" and were specified by this manufacturer for the job.



ASSURED ACCURACY — To assure that holes in planer cutter head assemblies provide precise fits for set screws, SKIL Corporation, Chicago, checks for accuracy with Besly-Metro Double End Reversible Cylindrical Plug Gages. Two opposed blades have three holding set-screws and another for adjusting position.

Prove to yourself that Besly Cutting Tools and Gages produce better results. Put them on trial on your toughest jobs, and check the difference in longer tool life, less down time, fewer rejects and faster production. If you'd like to try Besly tools or use Besly's Engineering Service, see your Besly distributor for details, or write us . . .

Engineering, Service and "Specials". . . are a Besly Specialty

BESLY

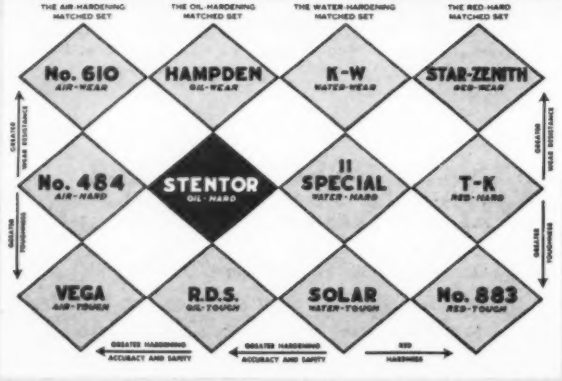
BESLY-WELLES
CORPORATION
Est. as C. H. Besly & Co. 1875
144 Dearborn Avenue,
South Beloit, Illinois

TAPS • DRILLS • REAMERS • END MILLS • TOOL BITS • GAGES
CARBIDE TIPPED TOOLS, BLANKS, THROWAWAY INSERTS and HOLDERS

CIRCLE INFORM-A-GRAM KEY NO. 143

now

Once again, Carpenter Metallurgists prove their desire and ability to pace the field in developments you want and need!



Like all Carpenter Matched Tool and Die Steels every bar of STENTOR (Oil-Hard) is colored full length in its own distinctive color for quick, positive identification! Immediate availability from your local Carpenter Mill-Branch Warehouse, Office or Distributor.

® U.S. Patent Office

..Carpenter extends the built-in safety factor of STENTOR (oil-hard) tool and die steel!

Remarkable heat treating versatility . . .
safe, dependable hardening through a broad range of 1425°F to 1525°F

The many advantages which make STENTOR one of industry's most used and talked-about steels are affected in no way by this exclusive new development. Its simplified analysis remains unchanged. It is still the *easiest* and one of the *safest* oil-hardening steels to harden. Requires no preheating whatsoever. Hardens from a lower temperature. Assures you less size change and distortion . . . uniform hardenability . . . full freedom from decarburization . . . long, dependable service.

And NOW . . . an extended Built-In Safety Factor enables you to heat treat STENTOR tools, dies and parts either of two ways: (1) At temperatures as low as 1425°F for the cost savings this brings you . . . or (2) Place them right in the furnace with other tools that are heat treated at temperatures up to 1525°F, and eliminate special furnace runs.

If you are not already using Carpenter STENTOR, it's time to *re-evaluate* the *extra* advantages you get with this versatile die steel.

JUST PRINTED! For more facts on how you and your men can Step Ahead with STENTOR, drop us a line on your Company letterhead for this new descriptive folder.

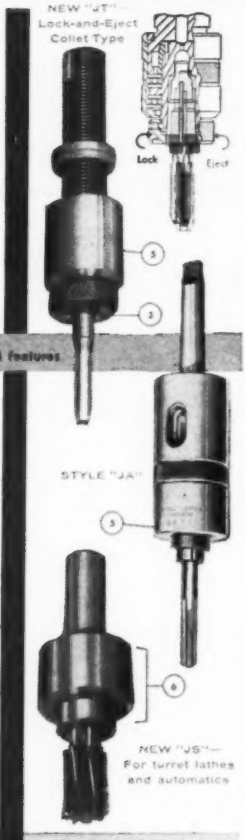
Carpenter STEEL

Matched Tool and Die Steels

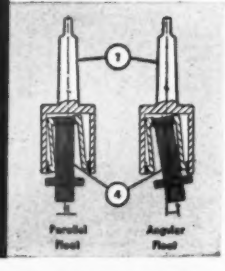
The Carpenter Steel Company, 106 W. Bern St., Reading, Pa.
Export Dept.: The Carpenter Steel Co., Port Washington, N. Y.—"CARSTEELCO"

CIRCLE INFORM-A-GRAM KEY NO. 145

You buy Scully-Jones "PREMIUM FEATURE" FLOATING HOLDERS AT NO PREMIUM IN PRICE!



These benefits . . .	for these reasons . . .	result from these PREMIUM features
HIGHER QUALITY WORK	No "binding" or dead spots to cause ball-mouthed, out-of-round, or poorly finished reamed holes. No oversized or tapered threads when tapping.	1. Exclusive double-gear spline drive provides a balanced, constant velocity, and a flexible drive coupling which permits freedom of lateral or angular movement.
LOWER CUTTING TOOL COSTS	No "cramping" to break fine cutting edges.	2. Two thrust bearings placed close together and independent of drive, as well as proper clearance in the spline, allow tool to float freely and quickly into proper alignment.
INCREASED PRODUCTION	Less downtime due to cutting tool breakage.	
	Tool changes are fast and easy.	3. New Lock-and-Eject Type Chuck (Style "JT" only) eliminates need for conventional-type drift.
LOWER MAINTENANCE COSTS	Positive, self-lubricating action practically eliminates wear.	4. "Rocking" action with spline drive coupling causes continuous flow of lubricant in and out of splines, and cushions drive against torsional shock and overload. Shell houses floating and driving elements, and acts as perfect seal for lubricant.
LOWER TOOLING COSTS	Holder may be used for most close-center and multiple-spindle operations.	5. Small body diameter.
	Requires little space between spindle and work.	6. Minimum body projection (Style "JT" and "JS").



SCULLY JONES

Call your Scully-Jones factory-trained representative or distributor for complete information and prices.

PRECISION HOLDING TOOLS

"Precision Holding" for holding precision

Scully-Jones and Company, 1913 South Rockwell Street, Chicago 8, Illinois

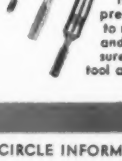
For profit-minded tool buyers!

"TOOLITROL" BOARDS
Take the human element out of multiple-spindle operations, help control quality and production.

NEW TENSION AND COMPRESSION TAP HOLDERS
Lock-and-eject chuck speeds tool changes, increases holding power.

HEAVY-DUTY TAP DRIVERS
Improved snap-ring design increases accuracy and holding power, speeds tool changes.

PRESETTING TOOLS
Reduce setup time, down-time, and inspection time by as much as 50 per cent.



TURRET TOOL HOLDERS
Hardened and precision ground to resist nicking and wear, assure accurate tool alignment.

CLOSE CENTER TAP DRIVERS
New design with four-slot chuck increases resistance to pull-out, keeps taps running true.

CIRCLE INFORM-A-GRAM KEY NO. 146

Will You Be There?

Feb. 1-2. Ninth Annual Industrial Engineering Institute. Held in simultaneous sessions at the Berkeley and Los Angeles campuses of the University of California.

Feb. 5-7. New England Production Ingenuity Show. The Hotel Bancroft, Worcester, Mass.

Feb. 5-7. Society of the Plastics Industry, Reinforced Plastics Division. Technical and Management Conference. Edgewater Beach Hotel, Chicago.

Feb. 8-9. Administrative Applications Division, American Society for Quality Control. First Annual Conference, Chicago.

Feb. 19. Rochester Society for Quality Control. 13th Annual Quality Control Clinic. War Memorial, Rochester, N. Y.

Mar. 6-8. Pressed Metal Institute. Annual Spring Technical Meeting. Hotel Carter, Cleveland.

Mar. 11-15. 1957 Atomic Exposition and Nuclear Congress. Convention Hall, Philadelphia, Pa.

Mar. 13-15. National Fluid Power Association. Spring Meeting. Hollywood Beach Hotel, Florida.

Mar. 18-20. American Society of Mechanical Engineers. Gas Turbine Power Conference. Detroit.

Mar. 18-21. First Military Automation Exposition. New York Trade Show Building.

Mar. 18-21. Institute of Radio Engineers. Annual Show. Coliseum, New York City.

Mar. 18-21. Society of the Plastics Industry. Annual National Conference and Pacific Coast Exposition. Los Angeles.

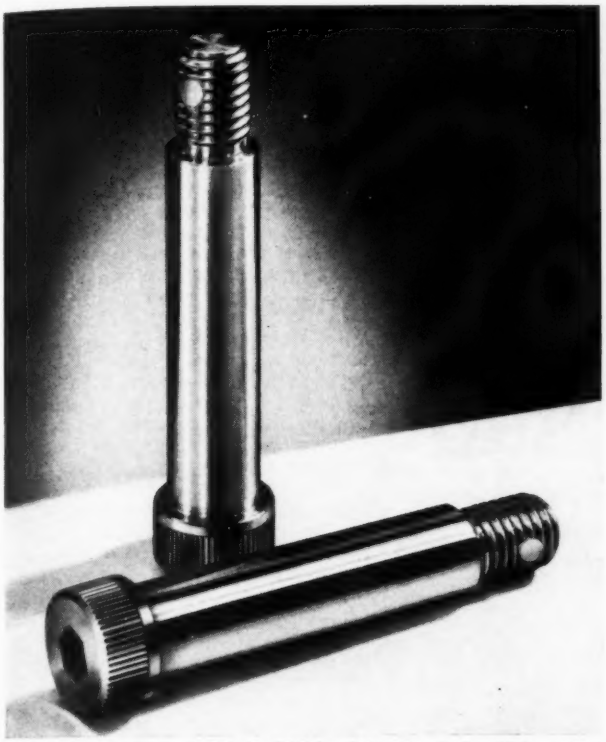
Mar. 20-22. Society of Automotive Engineers. Production Meeting and Forum. Hotel Statler, Buffalo.

Mar. 25-27. American Society of Tool Engineers. Silver Anniversary Technical Meeting and Convention. Shamrock Hilton Hotel, Houston, Tex.

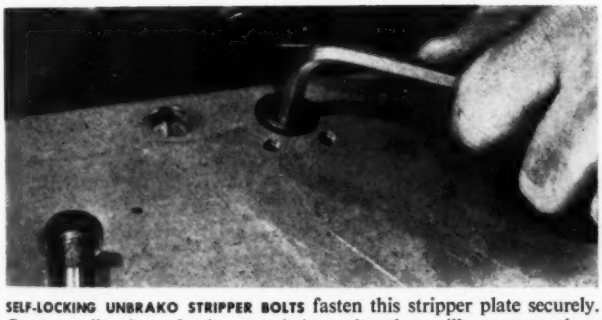
Mar. 25-29. American Society for Metals. 10th Western Metal Congress and Exposition. Pan-Pacific Auditorium and Ambassador Hotel. Los Angeles, Calif.

Mar. 27-28. American Society of Mechanical Engineers. Engineering Management Conference. Pittsburgh.

UNBRAKO STRIPPER BOLTS NOW AVAILABLE WITH THE NYLOK* SELF-LOCKING DEVICE



UNBRAKO STRIPPER BOLTS with the Nylok self-locking device. Nylon pellet locks them with positive, dependable prevailing torque action. Bolts are reusable.



SELF-LOCKING UNBRAKO STRIPPER BOLTS fasten this stripper plate securely. Constant vibration, shock, extended running time will not cause these bolts to loosen.

Self-locking UNBRAKO stripper bolts (shoulder screws) save time, money and headaches wherever they are used. They eliminate the costly, time-consuming checking of bolts to see that they are securely tightened. They protect precision tools and dies from damage caused by vibration-loosened bolts. They assure that your equipment will have longer service life, with reduced maintenance and downtime.

UNBRAKO stripper bolts are manufactured to the highest standards of precision. They are made of heat-treated alloy steel with continuous grain flow lines and have fully formed Class 3A threads finished close to the shoulder for maximum strength and holding power. Shoulders, held to fine tolerances, are concentric with heads and threads for uniformly accurate fit. The tough, resilient, *permanent* nylon locking pellet is integral with the threaded section.

All standard UNBRAKO socket screw products are available with or without the Nylok self-locking device. Authorized industrial distributors stock them. Write us for catalog and technical data on the complete line. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 36, Pa.

*T.M. Reg. U.S. Pat. Off.. The Nylok Corporation

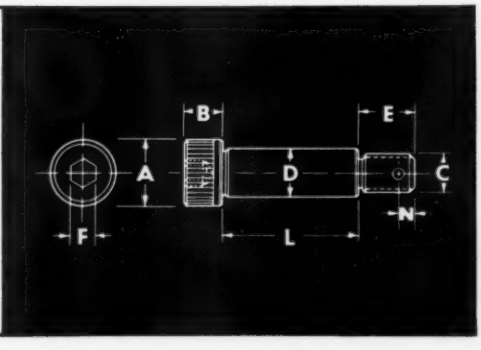
UNBRAKO® SOCKET SCREW DIVISION

STANDARD PRESSED STEEL CO.

SPS

JENKINTOWN ■ PENNSYLVANIA

D	Shoulder Diameter*	¼	5/16	⅜	½	⅝	¾
C	Thread Diameter UNC	10—24	¼—20	5/16—18	⅜—16	½—13	⅝—11
E	Thread Length	⅜	7/16	½	⅝	¾	⅞
A	Head Diameter	⅜	7/16	9/16	¾	⅞	1
B	Head Height	3/16	7/32	¼	5/16	⅜	½
F	Size of Hex. Hole	⅛	5/32	3/16	¼	5/16	⅜
N	Pellet Location	.141	.172	.187	.203	.234	.281
	*Shoulder Diameter Tolerances Max.	.249	.3115	.374	.499	.624	.749
	*Shoulder Diameter Tolerances Min.	.248	.3105	.373	.498	.623	.748

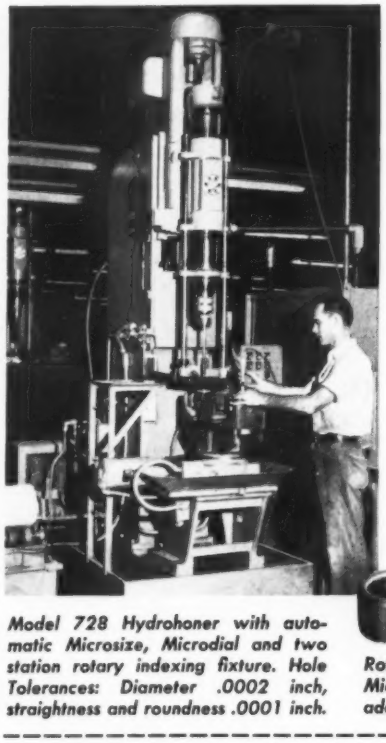


SPECIFICATION DRAWING. UNBRAKO stripper bolts are available with standard shoulder lengths ranging from ⅜ to 6 in.

CIRCLE INFORM-A-GRAM KEY NO. 147

WHY Emerson Electric MICROHONES Laminated Steel Rotors

The Emerson Electric Manufacturing Company is constantly searching for the best possible processing methods. Working with Micromatic engineers on problems encountered in processing shaft holes in their laminated steel rotors, Emerson Electric found that Microhoning would provide much higher production quality while lowering processing costs. The following Microhoning benefits are now obtained:



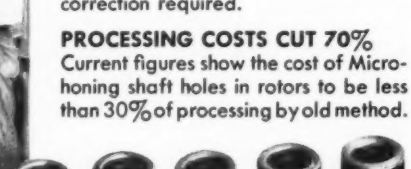
CUT REJECTS
With former processing method rejects ran too high. Microhoning controls size and assures a clean hole—rejects are substantially reduced.

ELIMINATED OPERATIONS
Old processing method required two operations. In one operation, Microhoning generates size and straightness within specified tolerances.

REDUCED BALANCING TIME 70%
To preclude vibration and poor operating characteristics, it is essential that shaft hole be concentric with O.D. of rotor. Microhoning reduced by 70% the amount of dynamic balancing correction required.

PROCESSING COSTS CUT 70%
Current figures show the cost of Microhoning shaft holes in rotors to be less than 30% of processing by old method.

Model 728 Hydrohoner with automatic Microsize, Microdial and two station rotary indexing fixture. Hole Tolerances: Diameter .0002 inch, straightness and roundness .0001 inch.



Rotors (from 2¼ to 4 inches long) are all Microhoned on the same machine by changing adaptor in fixture and resetting stroke length.

Learn why Microhoning will give you efficient stock removal, closer tolerances, accurate alignment and functional surfaces.

☐ Please have a Micromatic Field Engineer call.
☐ Please send Micromatic literature and case histories.

NAME_____

TITLE_____

COMPANY_____

STREET_____

CITY_____ ZONE____ STATE_____ D

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 148

SUPERVISORS NEED BONUSES TOO

by Ernest W. Fair

BONUS PLANS to induce greater safety, reduction of accidents, and more work output have long been used in every branch of industry. In many instances, however, supervisors have been entirely neglected or are taken into the plan only on a general basis. Much of the effectiveness of an incentive plan is thus lost to a very important degree.

The nature of a supervisor or foreman's job make it best to set up his part in the incentive program on an individual application basis. This assures greater responsibility, setting it up where there is an element of partnership between the individual supervisor and management, and increases inter-departmental competition in the program which always ensures greater effectiveness in the long run.

In setting up an incentive program for supervisors and foremen, it is best to first consider and analyze all factors which contribute to the unit result desired by the program, and then eliminate those which are not definitely measurable as well as all factors which are not exclusively in the control of the individual supervisor or foreman.

The program should also include factors to encourage company-wide or departmental efficiency, with the incentive based in some measure on the degree of effectiveness the supervisor is able to obtain within his own department or group.

It is also important that we make the factors involved positive ones rather than negative. A positive procedure is always easier for a supervisor to install and put into action; the "do not" or "shall not" factors are not only more difficult to implement but being negative by nature serve to depress the enthusiasm of the individual supervisor, both toward the company-wide program and his own role therein.

Any such program must also be set up on such a basis that will make all tasks equitable for the various supervisors. When one has a distinct advantage over another, there is less incentive to attain a given goal and a situation develops wherein we are left with compliance only to a level necessary to "make a good showing." The element of competition between different divisions or departments is always greater at the supervisory level than between individual workmen therein.

It is also good procedure to talk over any such program with the supervisors and foremen themselves before the final plan is drawn up. Such cooperation, even if it secures but small results in the form of prac-

tical suggestions, builds up an interest in the program hard to obtain otherwise. Junior executive personnel will invariably work harder on a given program in which they have a part of creation than in one wherein no consultation of any kind was made beforehand.

A supervisors' program should also include attention to ability to obtain worker cooperation, increased quality of work output as well as quantity, more economy in production of output both directly and indirectly, more attention to fulfillment of schedules, maintenance and housekeeping, accident prevention, and harmony of workers under his supervision.

These are direct responsibilities of supervisors in any program developed by the firm. The basis of their reward for fulfillment of the program within their department should be adjudged to *these* responsibilities. Basing their rewards solely on those factors set forth for workers fails to take into account the supervisory nature of an individual's job and, by offering no reward for extra performance of his individual tasks, invariably reduces the overall results obtained in the program.

The need for emphasis of quality within the supervisor's department should never be overlooked in such a program. Without it we will note a tendency to sacrifice the element of quality for that of quantity in order to obtain the previously set quotas or goals. When extra incentives are provided for supervisors and the basis for their award is made solely on a quantity basis, we can hardly expect anything other than their concentration on that quantity factor.

It is of even more importance to emphasize such quality factors in setting up the supervisor's or foreman's part in a bonus program for this is a responsibility within his province. Just as one of our main reasons for setting up such a program is to encourage quality of performance by workers, so also should it encourage quality in performance at the supervisor's level as it pertains directly to his job responsibilities.

The supervisor's schedule should also include emphasis on economy of direct materials, particularly in those instances where prices of such supplies or materials used under his supervision are subject to frequent wide variation.

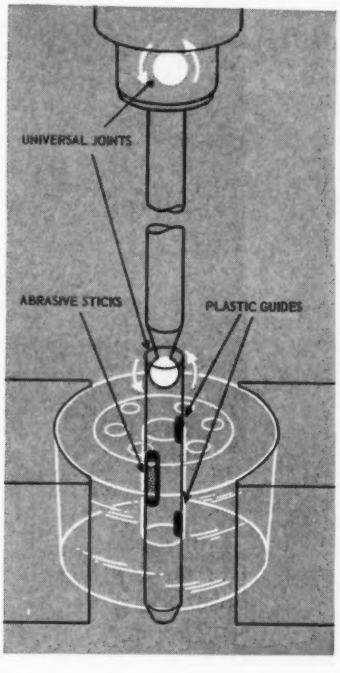
So also should fulfillment of schedules be made a definite part of the program for supervisors. Usually any program which places this responsibility with the individual workman obtains meager results primarily because it is a management function. Its place in the supervisor's program is highly advisable since this is a point of emphasis desired in

. . . Continued on page 153

HOW MICROHONING Laminated Rotors Cuts Processing Costs

Emerson Electric squirrel-cage rotors are made of special "electrical grade" steel laminations and each lamination is coated with oxide insulation. In processing the rotor, the O.D. is turned concentric with the shaft hole. Then, in one operation, Microhoning accurately generates finished size and straightness of shaft hole without any change in hole location.

The Micromold tool has two universal joints in the drive shaft which allow the tool body to align itself with the shaft hole. Microhoning of holes is along same axis from which O.D. was turned.



For electrical and mechanical efficiency, assembled motors must have a uniform air-gap between rotor and stator of .006 inch to .011 inch. Because laminated surface is rough and close tolerances must be held, special guided Micromold tools are used. Plastic guides above and below abrasive sticks, control dressing of abrasive and assure generation of round, straight shaft holes.

Before installing Microhoning equipment, two operations were required to finish shaft hole—rejects ran high. Microhoning greatly reduced the amount of dynamic balancing correction required.

The principles and applications of Microhoning are explained in a 30-minute, 16 mm, sound movie, "Progress in Precision" . . . available at your request.

☐ Please send me "Progress in Precision" in time for showing on_____(date).
☐ Please have a Micromatic Field Engineer call.
☐ Please send Microhoning literature and case histories.

PRECISION PRODUCTION THROUGH MICROHONING MICRO MATIC

NAME_____
TITLE_____
COMPANY_____
STREET_____
CITY_____ ZONE____ STATE_____ D

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 149

Now... Gorton Milling Machines Feature Hydraulic 3-Dimensional Controls

"Pencil" Pressure Does the Work

Gorton now offers you several models of Super-Speed Vertical Mills equipped with sensitive and accurate hydraulic controls featuring feeds up to 40 inches per minute.

AVAILABLE 3 WAYS

1. Vertical action only
2. Cross and longitudinal
3. Three-dimensional combination

Gorton Milling Machines with hydraulic Tracer Control must be ordered as such. Hydraulic equipment is not an attachment but a permanent installation.

For die or mold work (single or multiple units), production profiling and duplicating — short runs, experimental pieces or high production.

Gorton also offers manual and automatic Tracer-Controlled Milling Machines and Pantographs for 2- or 3-dimensional operation; 1 to 1 ratio, or reproduction at variable reductions, with single or multiple-spindle machines for work of any shape or size.

Shown above: Gorton 9-J Super-Speed Vertical Mill with True-Trace hydraulic installation.

Write for Form 2697-ADS and 1202-1655 General Catalog.

GORTON

GEORGE GORTON MACHINE CO.

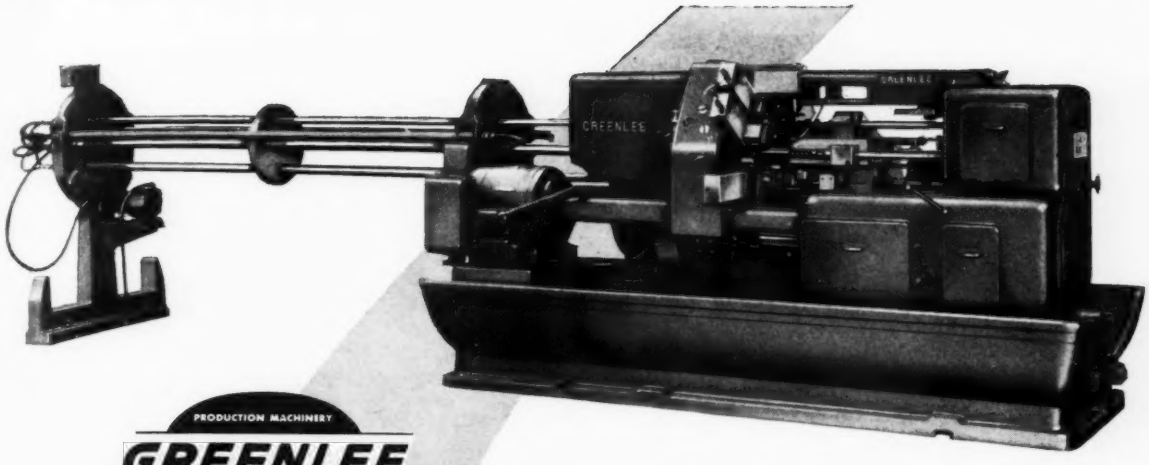
1202 RACINE STREET • RACINE, WISCONSIN, U.S.A.

SINCE 1893

Tracer-Controlled Pantographs, Duplicators — standard and special . . . Horizontal and Vertical Mills, Swiss-Type Screw Machines, Tool Grinders, Small Tools and Accessories.

A 8731-1P

CIRCLE INFORM-A-GRAM KEY NO. 150



PRODUCTION MACHINERY
GREENLEE

AIR-FEED AUTOMATIC

- **1 Permits Greater Job Versatility**
- **2 Easily Adapted to Multiple Feedouts**
- **3 Provides Longer Stock Feedout**
- **4 Eliminates Stock Scoring**
- **5 Reduces Stock Reel Noise**
- **6 Eliminates Stock Pushers**
- **7 Eliminates Feedout Cams**

Write today for Catalog A-405, or better still, have the Greenlee man call and show you the way to more profitable production with this air-feed automatic bar machine.

GREENLEE STANDARD AND SPECIAL MACHINE TOOLS

- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Six and Four-Spindle Automatic Bar Machines
- Hydro-Borer Precision Boring Machines

GREENLEE BROS. & CO.

PRODUCTION MACHINERY
GREENLEE

2042 MASON AVE.
Rockford, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 151

CLOSE TO YOUR WORK

for more convenience, speed and accuracy

COVEL No. 12A

CUTTER AND TOOL GRINDER

with Pope Tilting Head

Tool room men appreciate the extra operating convenience they get with Covel's T-Base design. It lets you get right up close to the work whether you stand at front, sides or back. Tool room grinding is speeded up too, by the Pope Tilting and Swiveling Head which permits faster setups with clearance angles read directly from the scale on the head. Clearance angles are *set without disturbing work!* You get all this, plus extreme accuracy! Covel advanced engineering design with ball bearing table, hardened and ground screws and hardened and ground ways preserves long-lived precision performance.

SEE HOW THE POPE TILTING HEAD SAVES TIME

COVEL PRECISION GRINDERS
BENTON HARBOR, MICHIGAN

Write for BULLETIN No. TP-27

Covel offers the Widest Choice in Surface Grinders up to 14" x 24" • Cutter and Tool Grinders • Drill Grinders • Optical Comparators

CIRCLE INFORM-A-GRAM KEY NO. 152

... Bonuses from Page 149

making his own day-to-day job performance of greater value to the company.

His bonus program should also contain some emphasis on maintenance and good housekeeping. Maintenance is usually a supervisory function; if it is ignored in the bonus program, it can easily be forgotten by the supervisor. After all, the end result of winning the competitive race is the one the supervisor will have in mind. If all considerations of maintenance and good housekeeping are left out of the schedule, they will be overlooked to the over-all detriment of the whole program insofar as the company is concerned.

The same reasoning applies to accident prevention. The enthusiasm of individual workers to attain reward goals will often lead them into accident-prone practices. It is up to the supervisor to see that this does not happen. If such a stipulation is made an integral part of his own individual program, we may be assured that he will place great emphasis on this phase of the job. Certainly every incentive plan should take into consideration that no results obtained without complete absence of accidents will be completely satisfactory.

Whatever factors are decided upon as being necessary to the incentive program for supervisors and foremen, it is of even more importance that such a program be separate and distinct from that covering company employees. The results we can obtain from any employee incentive program will depend in large measure on the incentives we set up for foremen themselves to see that the program is properly carried out under their own jurisdiction.

———•———

Cone Automatic Machine Co., Inc. of Windsor, Vt., has taken over the manufacturing and sales rights of the H.E.B. Pilot automatic copying lathe under a licensing arrangement with a French machine tool builder. The machine will be known as the Conomatic Pilot.

NECROLOGY

Robert O. Knudson, 65, assistant sales manager of the special machine tool department of Greenlee Bros. & Co., Rockford, Ill., died Dec. 19 after an illnes of four weeks. He had been with the company for 34 years.

Leroy J. Ackermann, 37, Eastern representative for the Lindberg-Fisher Division of Lindberg Engineering Company, died suddenly Dec. 11 at Baltimore.

WHEELOCK, LOVEJOY & COMPANY, INC.
1250 Marquette Street, Cleveland Ohio

WHEELOCK, LOVEJOY & COMPANY, INC.
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7 WAREHOUSES AT YOUR SERVICE

You'll get quick action on your order for alloy steel bars, billets or forgings . . . no matter what size, shape or heat treatment you require . . . when you call any one of our seven warehouses.

All seven are conveniently located in principal industrial areas.

Each is staffed by expert metallurgists, and is well-stocked to give you speedy service.

Fill your current needs by ordering our own HY-TEN steels, the "standard steels of tomorrow", or standard AISI or SAE grades.

Or write today to our Cambridge office for your *free* Wheelock, Lovejoy Data Sheets. They contain complete technical information on grades, applications, physical properties, tests, heat treating, etc.

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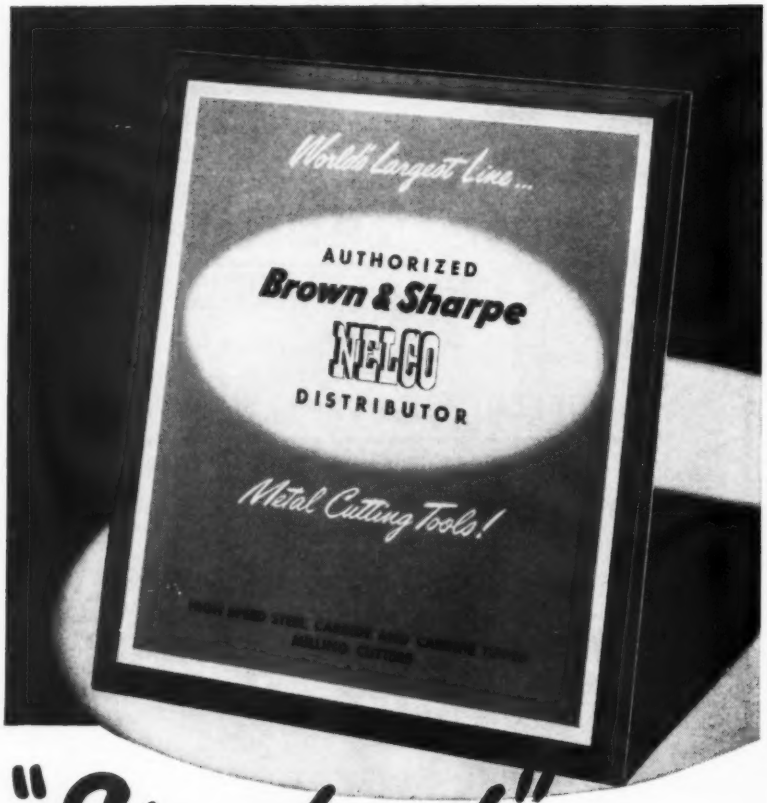
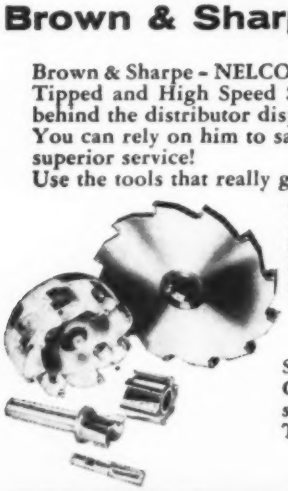
135 Sidney Street, Cambridge 39 Massachusetts

CIRCLE INFORM-A-GRAM KEY NO. 153

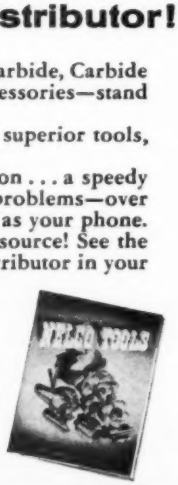


"Standard" MILLING
CUTTERS BY THE THOUSANDS!
... from stock—through your
Brown & Sharpe—NELCO distributor!

Brown & Sharpe - NELCO—manufacturing over 3000 Carbide, Carbide Tipped and High Speed Steel milling cutters and accessories—stand behind the distributor displaying this plaque.
You can rely on him to save you days and dollars with superior tools, superior service!
Use the tools that really give you a COMPLETE selection . . . a speedy solution to all your cutter problems—over 3000 "standards" are as near as your phone. Switch to the most complete source! See the Brown & Sharpe-NELCO Distributor in your area . . . today!



SEND for the New Nelco Catalog just off the press, showing over 700 Carbide Tipped Cutting Tools.



NELCO TOOLS
For that EXTRA Edge in Production!
NELCO TOOL COMPANY, INC. • MANCHESTER, CONNECTICUT

CIRCLE INFORM-A-GRAM KEY NO. 154

NEW GAP PRESSES DESIGNED FOR AUTO PARTS PRODUCTION

A new line of Hamilton gap presses — ranging in capacity from 100 to 300 tons in both single and double crank types — has been developed primarily for shallow drawing, forming and blanking duty in the automotive industry. They are also applicable in other industries such as appliance manufacturing. The presses have bed areas large enough to accommodate the more sizable blanks that are formed into auto-body grille and bumper guards. Such parts have made these intermediate size presses increasingly important to the automotive industry.

Single and double crank types are built by Baldwin-Lima-Hamilton Corp. to meet the width requirements of the blanks. Exceptionally rugged welded steel construction of both frame and slide assures low deflection, strength and rigidity. Gears — both main and intermediate — run in oil to afford positive lubrication.

The presses incorporate a pneumatically-operated flywheel brake, pneumatic clutch with electric control system, and pneumatic counterbalance. Mechanical interlocking between clutch and brake assures optimum performance and safety.

Developments in the use of hard carbides last year were outstanding in three respects, reports Philip M. McKenna, president of Kennametal, Inc. of Latrobe, Pa. These are the rapid adoption of throw-away insert tools, increased and ample supply of tungsten and cobalt for uses other than as cutting elements, and greater use of these metals where high strength is required at high temperatures.

At Your SERVICE

Facilities for design, development, and manufacture of copper and silver brazed assemblies are made available by Wall Colmonoy Corp. of Detroit. Among the parts produced are brazed tube assemblies, brazed levers and linkages, brazed assemblies of stamped components, and brazed hydraulic and vacuum fitting designs.

◆

Keystone Carbon Co., Saint Marys, Pa., has expanded its gear design services. The company is now offering a complete service from original design to finished production on mass-produced powdered metal gears.

◆

A modern annealing furnace for the Wallingford, Conn. plant has been acquired by Ulbrich Stainless Steels Co. With this equipment, the company is able to convert stainless steel strip and flat wire to consumer specifications, hard or soft, in any gauge from 0.001″ to 0.050″.

◆

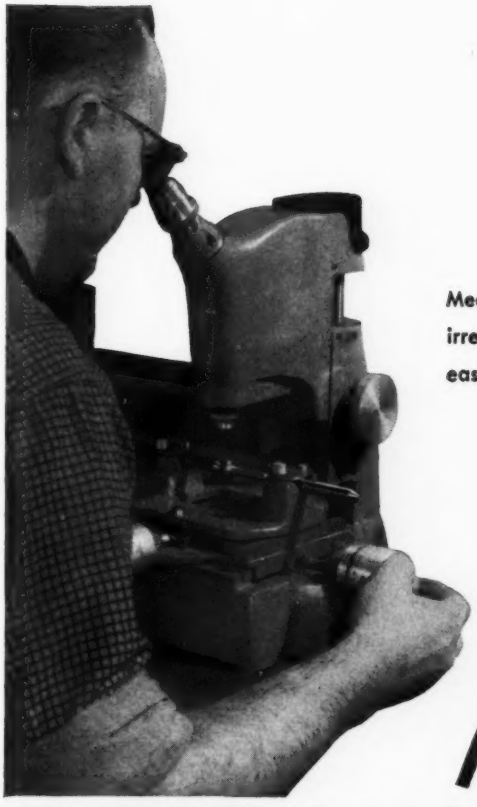
Specialized injection molding of tiny thermoplastic parts is handled by Gries Reproducer Corp. of New Rochelle, N. Y. The company specializes in extremely small parts, maximum weight, 0.03 oz and maximum length, 1¼″. Threaded inserts, wires, metal stampings, tape, etc. are automatically inserted in parts during the molding process, either as individual inserts or as continuous elements.

◆

Mold design, mold making, and the actual molding process are consolidated by Byrd Plastics, Inc. of Erie, Pa., to cut production cost. The company is responsible for the entire job, serving industries using molding in thermoplastics, especially nylon.

◆

A new method of sharpening power hack saw blades on special precision machines has been developed by Peerless Tool, Inc., North Attleboro, Mass. New blade life is assured even on the third and fourth regrind for 1/3 the cost of a new blade. Blades are returned with sharper, squarer, and more uniform teeth than when new without affecting set or temper. The resharpened blades can be used successfully for cutting stainless, titanium and other metals.



Measures tiniest parts, irregular shapes . . . faster, easier, at a budget price

NEW

Bausch & Lomb TOOLMAKERS' MEASURING MICROSCOPE

All the features that most toolmakers need are efficiently combined in this sturdy, new precision-measurement instrument . . . at only $1200 for the complete basic equipment. Massive controls, conveniently grouped, assure steady, sharp focus on parts up to 2½″ in any dimension. Direct readings to 0.0001″; angular, to 1′ of arc. 2″x1″ travel accommodates wide range of work. Precision-ground centers (optional). Optically, mechanically, this new, low-cost microscope makes it easier to work to closer tolerances of precision. See for yourself in a free demonstration.

EXCLUSIVE! Fast, easy adjustment aligns crosshairs of eyepiece with x-y motion of stage for absolute precision of measurement.

TRULY VERTICAL illumination for study of deep cavities. Built-in illuminator provides ample, comfortable light for full-working-day use.

PROTRACTOR EYEPIECE (optional) is quickly, easily interchangeable with standard eyepiece; speeds accurate measurement of angles.

BAUSCH & LOMB OPTICAL CO.
79814 St. Paul Street, Rochester 2, N. Y.

☐ Send me informative new B&L Toolmakers' Microscope Catalog D-282

☐ I would like an obligation-free demonstration of the new B&L Toolmakers' Microscope

Name, Title.....

Company.....

Address.....

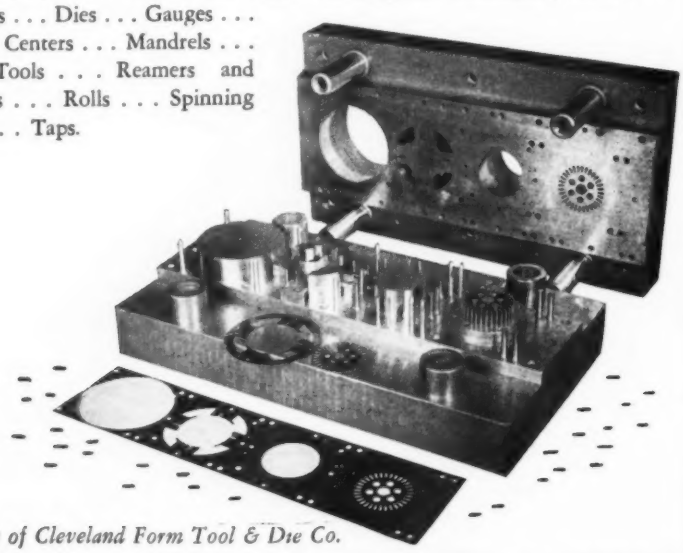
City..... Zone..... State.....

CIRCLE INFORM-A-GRAM KEY NO. 155

Darwin • NEOR •

for Quantity Production

"NEOR" is the original—and still finest—Oil Hardening, Non-Deforming High-Carbon, High-Chrome Tool Steel. Hardened "NEOR" withstands 240,000 p.s.i. and has not been tested to destruction. Correctly heat-treated, it will not deform or shrink. "NEOR'S" high resistance to abrasion makes it *first choice* for production in high quantities. Call on your Darwin sales engineer for cost-saving results with "NEOR" on: Brass Finishing and Burnishing Tools . . . Bushings . . . Dies . . . Gauges . . . Grinder Centers . . . Mandrels . . . Press Tools . . . Reamers and Broaches . . . Rolls . . . Spinning Tools . . . Taps.



Courtesy of Cleveland Form Tool & Die Co.

PRACTICAL RESULTS FROM "NEOR" USERS

Lamination or Notching Dies — New York firm blanking one quarter hard cold rolled chrome strip (1.25% C, 2% Cr.), 0.015" thick reports increases per grind . . . "NEOR"; 60,000—127,000; High Speed Steel: 30,000; Carbon Steel: 7,000.
Coining Press Dies — Detroit automobile manufacturer coin pressed 205,000 in first grind—16,000 with other dies.
Drawing Dies— Chicago manufacturer of automotive devices produced 20,000 per grind — previous best 400 to 800 (half hour run). Operation was drawing cold rolled strip steel (0.40-0.50 C) and .109" and 0.083" thick.
Trimming Dies — Philadelphia concern trimming semi-hot steel balls found "NEOR" die operated 25 hours—previous best 4 hours.
Slitting Cutters— Chicago can manufacturer ran "NEOR" cutters 7 days without regrind—others lasted 1 day.

Complete line of highest grade Tool Steels, including PRK-33, DARWIN No. 1, NEOR, MINEOR, OHT, "MT6" and various grades of Hot Work Specialty Steels. Furnished in Bar Stock, Billet and Sand Casting, Drill Rod, Flat Ground Stock and Tool Bits. Bulletin on Request.

DARWIN & MILNER Inc.

highest grade tool steels

2345 ST. CLAIR AVENUE ★ CLEVELAND 14, OHIO

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ZIV STEEL & WIRE CO., CHICAGO • DETROIT • ST. LOUIS • INDIANAPOLIS • TOLEDO • MILWAUKEE • M. G. OPP COMPANY, NEW YORK CITY • PECK STEEL & DIE SUPPLY COMPANY, LOS ANGELES • CHARLES B. WEBSTER, PLAINVILLE, CONNECTICUT • CHARLES W. BRINGMAN, ORLANDO, FLORIDA

CIRCLE INFORM-A-GRAM KEY NO. 156

. . . Records from page 120

machine tool number — thus the data was "mechanized" for high-speed processing.

3. Having collected that data, we prepared to use it quickly and effectively for preventive measures.

   A. First, we made immediate use of the data on failures in the form of a tabulated report sent monthly to each foreman. It indicates maintenance performed and labor and material cost for maintaining each facility in his section.

   B. Secondly, we set up permanent maintenance repair and replacement records in the Maintenance Department, and fed our data on failures into a steadily accumulating history. Each time a repair is made on a facility, the facts are entered on the record:
      Data
      Sub-assembly (code)
      Part (code)
      Reason for failure (code)
      Action taken (code)
      Labor cost
      Material cost
      Total and accumulated total

   C. But data is useful only if it can bring intelligent action, so we built a "warning" system into the Maintenance Record.

• First we established from experience an annual budget for normal maintenance, and indicated this with a red marker over that figure on the scale at the bottom of the card.

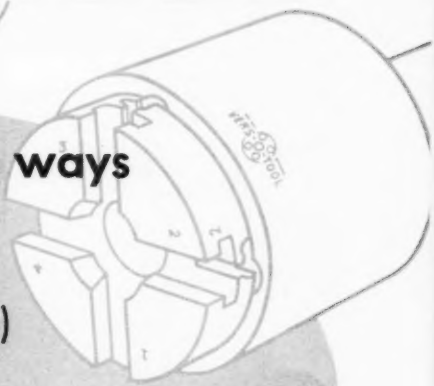
• Then we provided a green marker to move upward on the scale as expenditures accumulate during the year.

• When the green marker meets the red marker, the card is pulled and referred to the Superintendent of Maintenance for investigation and action. The results of this investigation may be used by Maintenance for corrective action, by Superintendent of Tools and Equipment for redesign, and by Purchasing Department when replacement facilities are being considered.

• For a 10-yr history of the facility we used the back of the form to accumulate maintenance and repair costs twice yearly over a period of years. We also provided a record on replacement parts.

Our experience so far with this system indicates that while time is needed to perfect it, the use of coding will provide detailed, accurate *convincing* data. In the form of monthly reports it is used in operations by the shop. In accumulating records, it is employed by Maintenance, by the Tools and Equipment Department, and by Purchasing to maintain, redesign, and purchase capital equipment which will provide greater productivity, reduced downtime, higher quality and larger profits. end

Namco VERS-O-TOOL



lets you use the same head – two ways

- with chasers . . . (for threading)
- with cutters . . . (for hollow milling)

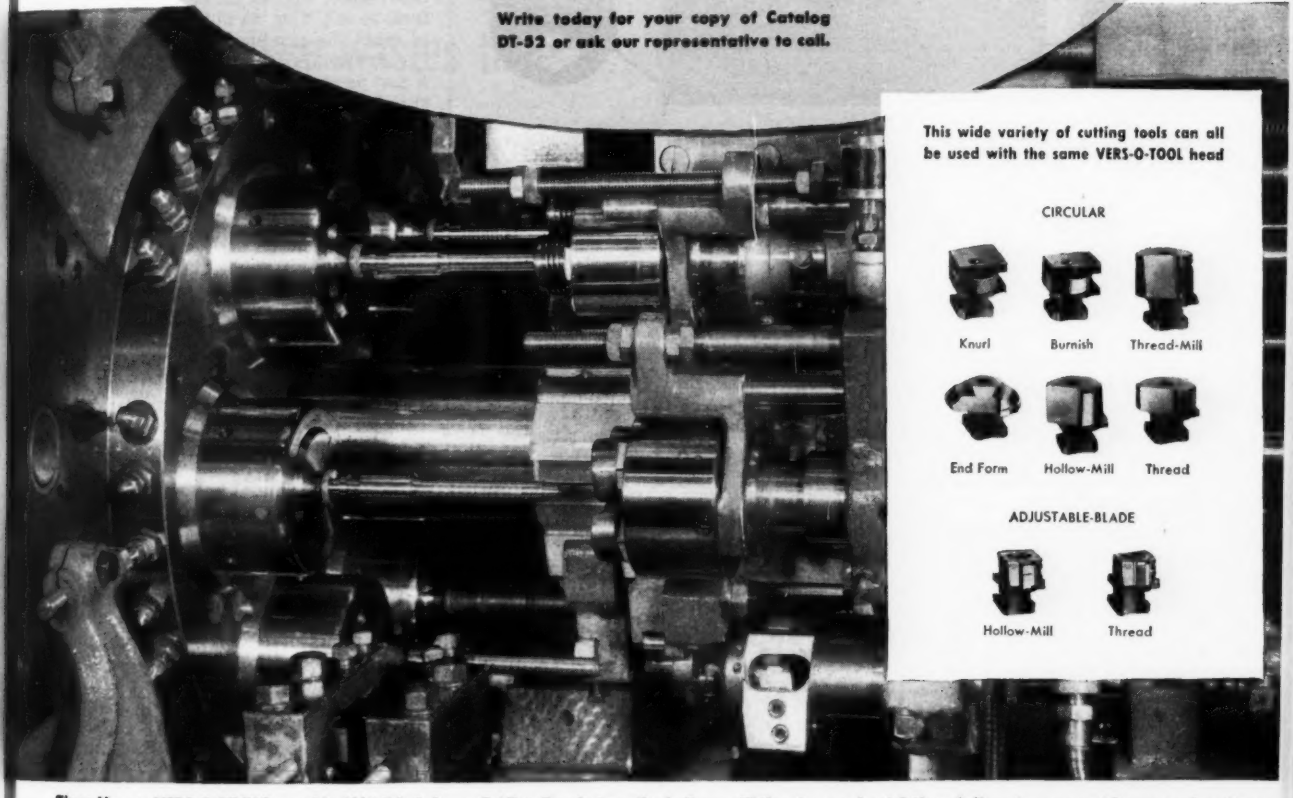
CIRCULAR CUTTING TOOLS reduce costs and speed production on threading jobs, end forming and turning.

GROUND THREAD CHASERS provide more threads per grind—and you can regrind to a full 270° of chaser circumference.

BASIC DESIGN SIMPLICITY— fewer moving parts —insures long, trouble-free performance.

NAMCO CHASER GRINDING SYSTEM permits cutter settings to be made in the toolroom without head adjustments—no need for trial error run after sharpening.

Write today for your copy of Catalog DT-52 or ask our representative to call.



This wide variety of cutting tools can all be used with the same VERS-O-TOOL head

CIRCULAR

Knurl Burnish Thread-Mill

End Form Hollow-Mill Thread

ADJUSTABLE-BLADE

Hollow-Mill Thread

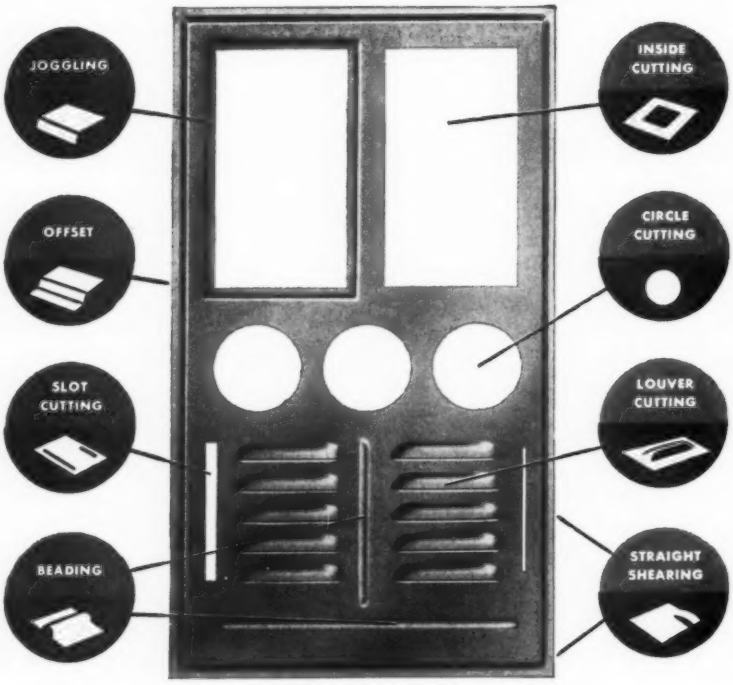
Three Namco VERS-O-TOOLS, on this 1¼" RA-6 Acme-Gridley Bar Automatic, hollow mill the stem and cut 2 thread diameters on cast bronze valve stem.

National Acme

THE NATIONAL ACME COMPANY, 169 E. 131ST ST., CLEVELAND 8, OHIO • Sales Offices: Newark 2, N. J., Chicago 6, Ill., Detroit 27, Mich.

PULLMAX METALWORKING IDEAS

Expensive dies eliminated with standard Pullmax Tools

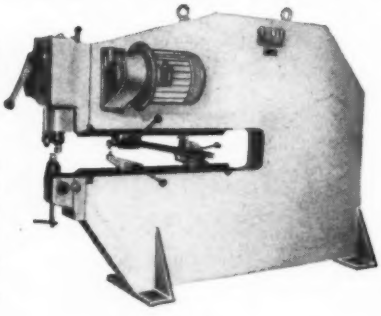


This instrument panel board made complete on a PULLMAX

Only the Pullmax universal shearing and forming machine has the versatility to do all of the metalworking jobs in your Model Shop, Engineering or Maintenance Departments.

This one versatile machine does straight shearing, inside or outside circle cutting, design cutting, inside square cutting, beading, joggling, slot cutting, louver cutting, dishing, edge bending and flanging.

7 sizes of machines cut up to 11/32" in mild steel. Ask for a demonstration right in your plant.



AMERICAN PULLMAX CO., INC.
2469 N. Sheffield Ave., Chicago 14, Ill.

MORE MONEY-SAVING METALWORKING IDEAS ARE YOURS IN THIS *FREE* BOOKLET

Please send us the Pullmax Catalog on Money-Saving Metalworking Ideas.

NAME_____

STREET_____

CITY_____ ZONE_____ STATE_____

TITLE_____

CIRCLE INFORM-A-GRAM KEY NO. 158

CARBIDE DIES GREATLY REDUCE STAMPING COSTS

The specifying of tungsten carbide for many applications where part quality, fewer rejects, or increased efficiency were prime consideration, rather than just a long production run, has paid dividends for the Standard Control Division of Westinghouse Electric Corporation's plant in Beaver, Pa.

The Beaver plant produces industrial circuit breakers in a wide range of capacities. The devices incorporate numerous intricate metal stampings, such as, magnet frames and armatures, trip latches, push rods, arc plates, etc. Some of the parts are fabricated from mild cold rolled steel, while others are stamped from tough stainless or from hard, abrasive, electrical silicon sheet steels.

Until fairly recent date, these dies were made of high carbon, high chrome or high-speed steel. While steel dies in many cases gave a more or less satisfactory performance, many dies for the same part were required due to a die being out of production so often, while being sharpened, that at times as many as four to six dies would be necessary to meet the production schedules.

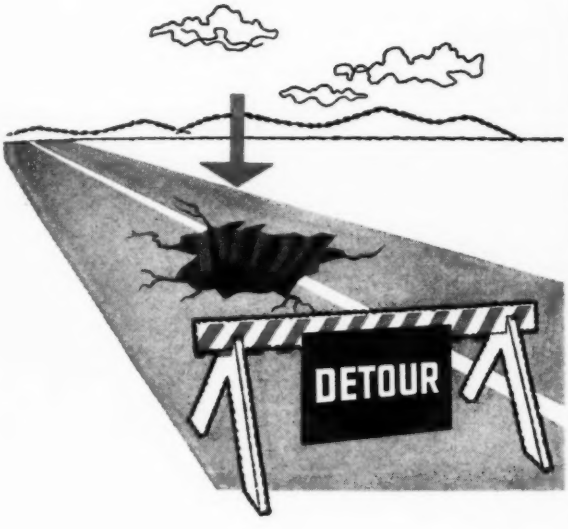
After studying the situation from a cost as well as a quality production standpoint, Westinghouse tool engineers consulted with Oberg Manufacturing Co., Inc., exclusive designers and builders of tungsten carbide dies, to determine the economic advantage of using tungsten carbide as a die medium for their more difficult stamping problems.

To better establish tungsten carbide as a proven die material, it was mutually decided to apply it first to a wear problem involving a relatively simple shape; then as each die more or less proved itself and as familiarity was gained with carbide relative to specific production problems, they would gradually work carbide into the more intricate and difficult shapes and problems.

One of the first parts which came up for examination was a special "E" and "I" type lamination stamped from high content silicon steel and used as magnet and armatures in a contacter frame. The high abrasiveness of this material and the assembly requirement of practically no detectable burr were conditions which could not be met without an inventory of many duplicate tool steel dies to keep press downtime within reason.

A progressive carbide die Oberg designed and built for this operation, although costing at that time three times as much as a tool steel die, now turns out more than 18 times as many laminations between sharpenings.

The practice at Westinghouse is to



a hole here wastes time...

a hole here saves time

Crucible Hollow Tool Steel Bars save time — and money too — whenever you need ring-shaped steel parts, or tools with a center hole. The tool steel is drilled through when you get it! You don't need to bore, drill, hole-saw, cut off or rough-face. That's why they cut your production time, increase machine capacity — and reduce scrap losses.

You can get these hollow bars in any of Crucible's famous quality tool steels, in almost any combination of OD and ID sizes. And you can get *immediate* delivery of five popular grades — KETOS oil-hardening; SANDERSON water-hardening; AIRDI 150 high carbon, high chromium; AIRKOOL air-hardening; and NU DIE V hot-work tool steels — from the Crucible warehouse near you.

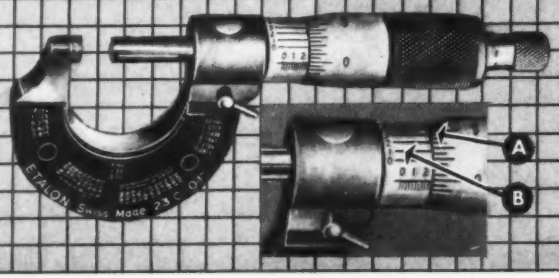
Call your Crucible representative for the full story of how these steels can save time and money in your shop. *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

CIRCLE INFORM-A-GRAM KEY NO. 159

ONE PIECE STAINLESS STEEL SPINDLE AND SCREW
Hardened and ground from the solid...



ETALON 23C MICROMETER

A—Half-thousandth graduations on thimble allow tenths readings with only 5 Vernier graduations.

B—Deep machine divided graduations on both thimble and barrel assure easy reading.

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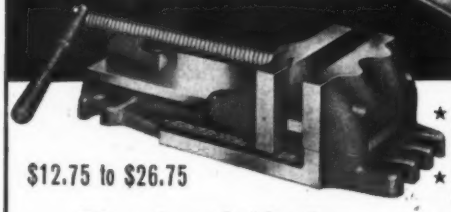

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★ Quick action design for speed. Opens instantly to full capacity to handle work of any size.
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★ Lift...slide...lock...that's all there is to the fast, positive locking action.
★ Heavy, semi-steel castings for extra strength and a heavy base plate for rigidity.

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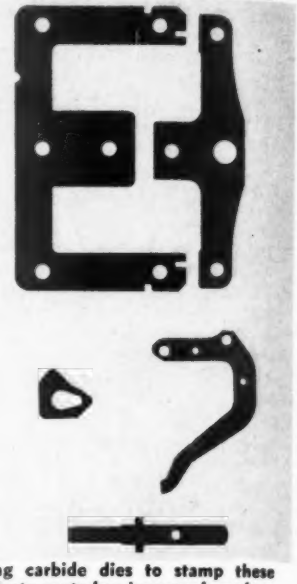
CARDINAL MACHINE COMPANY
1819 Dana Street, Glendale, California

CIRCLE INFORM-A-GRAM KEY NO. 1602

sharpen the die at the end of 500,000 strokes, although the die has run on occasions well over a million strokes without parts being rejected because of excessive burr. In sharpening carbide dies Westinghouse experience shows the best performance indicates that .001" be removed from the punch and die for each 100,000 strokes. Thus, Company practice has scheduled regrinds at optimum rather than the maximum limit of output.



Using carbide dies to stamp these intricate parts has increased production, minimized rejects, reduced press downtime and eliminated much excessive and costly inventory of spare dies at the Westinghouse Beaver, Pa., plant. (Upper row) "E" and "I" lamination, (middle row) catch bracket and trip latch, (at bottom) push rod.

A special characteristic of tungsten carbide which has enabled Westinghouse to produce better quality parts is its ability to hold a sharp cutting edge over long periods of use. For instance, a small circuit breaker catch bracket, 1/16" thick, is stamped from half-hard cold rolled steel. The part was formerly produced by blanking with a tool steel compound die and grinding the operating edge of the part at a second operation. With this method it required .00037 hrs to pierce and blank; and .00200 hrs for the grinding. This made a total of .00237 hrs or 8½ sec/pc for an optimum output of 420 pcs/hr.

Because a carbide die's cutting edges stay sharp longer, it was found feasible to close in the break clearance, thereby getting a cleaner cut and thus eliminating the subsequent grinding of the operating surface. Utilizing a progressive tungsten carbide die, the total blanking time was reduced to .00028 hrs or one second per part. The grinding operation was eliminated completely. The result is a total theoretical output of 3600 pcs/hr or a production increase of 850% because of fewer operations

NewMet* by NEWCOMER

The first all-new high velocity metallic cutting material

Capable of cutting performance beyond present machine capacities . . .

A result of ten years of Newcomer research and development, NewMet has opened an entirely new field for high velocity cutting of steel, cast iron and non-ferrous materials. Containing no strategic materials, NewMet is designed to outperform superbly at both normal cutting speeds or the higher ceramic and cemented oxide speeds . . . speeds of 1000 SFPM and more . . . 2 to 3 times the speed of existing "high speed" carbide cutting grades!

Economize with high velocity cutting . . .

Combining extreme hardness with a comparative high strength, NewMet has lasted 8 to 10 times longer than existing "high speed" carbide grades when operated at normal carbide finishing speeds. It's practically impervious to cratering and wear.

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Available now in NP "Throway" Triangular, Square and Round Inserts, and Solid Cylinders.

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PRODUCERS OF NP "YEARS AHEAD" CARBIDES

CIRCLE INFORM-A-GRAM KEY NO. 161

U. S. Steel Supply Provides Customers with **SMOOTH ACCURATE SHEARING**

One Shear Takes the Place of Two or Three

No. 12E-12 Steelweld Shear at U. S. Steel Supply, Seattle, Washington, rated for steel plate 12′ x ¾″. Being cut in photo is a plate, size 7′ x 30′ x ¾″. With hand crank on right end, this machine can be adjusted in a few seconds to have exactly the right knife clearance to obtain the finest cut for any thickness. To make this adjustment on guillotine-type shears usually requires several hours.

MANY steel warehouses have two and often three shears, one of a ¼″ capacity for lighter thicknesses, another of ½″ capacity for cutting ¼″ to ½″ material, and a third with 1″ capacity for thicknesses over ½″ and up to 1″. At some of its warehouses, U. S. Steel Supply uses only one machine for cutting the various thicknesses—a Steelweld Pivoted-Blade Shear.

One machine takes the place of two or three, because it is so easy to adjust the knife clearance required to obtain the best cuts for different thicknesses, which can range from lightest gauge metal to the heaviest plate within the capacity of the shear.

Thus, the investment in shearing equipment is kept low, yet the customers of U. S. Steel Supply are always assured of straight, smooth, accurately cut metal on every order.

GET THIS BOOK!

CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

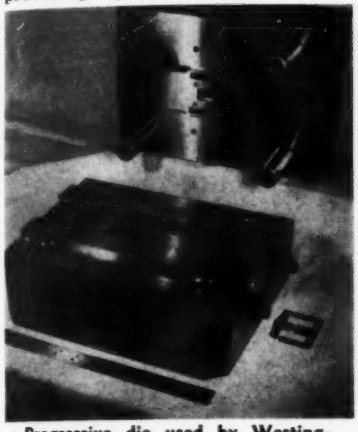
THE CLEVELAND CRANE & ENGINEERING CO.
8753 E. 282 STREET, WICKLIFFE, OHIO

STEELWELD PIVOTED BLADE SHEARS

CIRCLE INFORM-A-GRAM KEY NO. 162

and higher press feeds.

Almost the same situation prevailed with a trip latch. This is the critical part of a circuit breaker because fault current interruption depends upon it slipping off a catch plate at the slightest movement of a comparatively weak (in terms of operating power) bi-metallic element without delaying or resisting the element's movement. This part is stamped from half-hard cold rolled nitriding type steel 1/16" thick. It was formerly produced by blanking the part on a tool steel die, then in a second operation burnishing the latching surface to reduce friction by providing a polished face.



Progressive die used by Westinghouse Electric Corporation for blanking "E" and "I" laminations from high silicon steel. The carbide die, designed and built by Oberg Manufacturing Co., Inc., turns out more than 18 times as many lamination as a former tool steel die before it needs sharpening.

An increase in output was more or less a secondary consideration in the production of a small flat push rod stamped from stainless 1/16" thick. The major problem involved piercing a hole of .072" dia through the center of the part. The overall width of material at the location of the hole is only .184" which leaves only .056" for the side wall of the hole. The push rod has ample strength for its imposed duty in the control device, but piercing of the hole was almost impossible with toolsteel dies. Rejects were high because of cracks developing across the side walls of this small pierced hole.

A tungsten carbide die not only solved the piercing problem; it speeded output over 225%. With a steel die, production of each usable part took .00059 hrs, limiting maximum output to 1,693 pcs/hr. With the carbide die this time was cut to .00018 hrs per push rod to give an output of more than 5,500 pcs/hr. Rejects were held to a minimum.

Thus, teamwork between production management and die specialists eliminated assembly bottlenecks by increasing production, minimizing rejects, reducing press downtime, and eliminating, in many cases, excessive costly inventory of spare dies.

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Solid Web and Counter Balanced. Made of fine grain cast iron. Center hole and faces of hub are true to rim. Rims and handles are ground and polished to high lustre. Adds distinction to product. Top quality. Low prices. Many sizes. Immediate delivery. Alterations when required at nominal prices.

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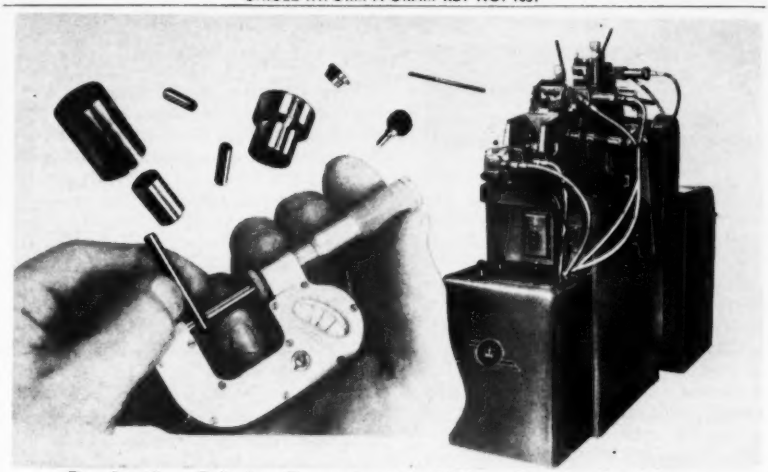

Production Grind - Tungsten Carbide - Steel - Stainless Glass - Plastic or Carbon to .0002 or 6 to 8 Micro finish *

on the ROYAL MASTER TG-12 Centerless Grinder

Apply the versatile Royal Master TG-12 to your grinding problem. It will finish grind from .004 to 1 ½ inches in diameter.

It may be used for either plunge or thrufeed grinding with conversion to either a matter of minutes.

It may be put to work **without** prior spindle warm up time with unparalled accuracy and dependibility - (Based on machines in use for 5 years.)

Low depreciation based on inital cost - Ease and speed of set up time due to accessibility of work zone - Rapid replacement of work wheel and packaged hydraulic system for automatic cycling, are other features of the TG-12. What are your requirements?

* **May we demonstrate the TG-12 for you on your parts?**

Also Grinds Wood, Non-ferrous Metals, Fibre, Hard Rubber, Cork, etc.

☐ **Please contact me regarding my "centerless grinding" requirements.**

☐ **Please forward literature describing the TG-12.**

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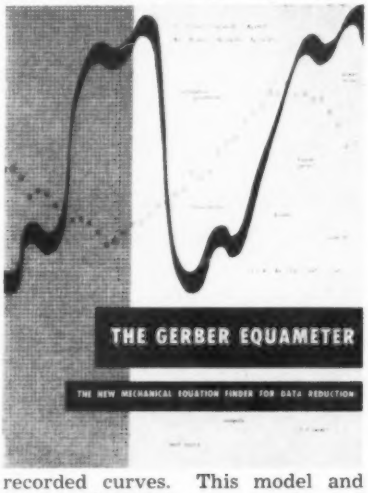
240 State Highway 23 Riverdale, New Jersey

CIRCLE INFORM-A-GRAM KEY NO. 1632

Business Management Aids

A Desk-Top Analog Computer has been produced by The Gerber Scientific Instrument Co., 162 State St., Hartford 1, Conn. Model GEQ-400 Equameter performs harmonic analysis and curve fitting on plotted or



recorded curves. This model and Model GEQ-450 are mechanical equation finders for data reduction. A general description, performance and applications are covered in a bulletin provided by the company, or—**Circle Inform-A-Gram No. F1.**

Automatic Production Recording Systems are featured in a folder issued by International Business Machines Corp., 590 Madison Ave., New York 22. These systems consist of standardized components designed to automatically collect, correlate, store and record production data from suitable measuring instruments. Illustrated in the folder are a few typical applications, and measured, identifying and production data. **Circle Inform-A-Gram No. F2.**

"Power and Natural Resources" provides data on more than 2300 communities in seven important metalworking states served by the American Gas and Electric System. These states include Michigan, Indiana, Ohio, West Virginia, Virginia, Kentucky and Tennessee. The brochure contains a large-size map that shows actual locations of natural resources, waterways, railroads and communities. Discussed in detail are the resources and power found in the seven-state area. Copies of the brochure are issued by American Gas and Electric Service Corp., 30 Church St., New York 8, or — **Circle Inform-A-Gram No. F3.**

Various Methods of Improving Management and Records Control are outlined in an eight-page illustrated booklet. It tells how industry and business can decrease operating costs and achieve greater profits. Modern records-producing equipment is causing a problem by increasing the volume of paper work. The first step in solving the problem is an inventory and appraisal of all existing records and the setting up of a retention schedule. This step and others in establishing records is followed through in Booklet BSD-45, "These White Elephants Are Made of Paper," made available by Remington Rand Div'n, Sperry Rand Corp., 315 - 4th Ave., New York 10, or — **Circle No. F4.**

Five Management Programs have been scheduled for Jan. 28-Feb. 18. They deal with production control and inventory management, methods improvement, work measurement, production and sales forecasting, and mathematical programming. A booklet describing each of the five programs and giving enrollment information is supplied by the National Institute of Management, Inc., 1008 National City Bank Bldg., Cleveland 14, or — **Circle No. F5.**

The Contoura-Constat Photocopier will make copies of anything printed or written in pencil, ink, ball-point, crayon or spirit duplicator on heavy opaque paper, translucent paper or film. This portable copier will perform effectively under any lights, even fluorescent. It makes sharp, photo-exact, permanent, black and white copies in 30 sec. For details, contact F. G. Ludwig, Inc., Old Saybrook, Conn., or — **Circle No. F6.**

"Dollar Savings through Standards," a survey report, highlights economic benefits to American industry resulting from use of standards. This report is an up-to-date version of the 1951 edition and contains 79 documented case studies covering 27 industrial fields. Information for the booklet was obtained by the American Standards Association through a special survey among its trade associations and technical society members, as well as company members. Request copies from American Standards Association, 70 E. 45th St., New York 17, or — **Circle Inform-A-Gram No. F7.**

"Humanics," the fifth booklet in the series on Cost Reduction for Industrial Management, has been released by Wheeler Associates, Inc., 15017 Detroit Ave., Cleveland 7. This booklet deals with the human or personal issues and problems in labor-management relations. Such topics as teamwork, planning, employee effort and creative ability are discussed in detail. One section deals with employee ideas, their treatment, modes of acceptance and rewards. The booklet ends with a discussion of the various mental attitudes assumed by both executive and production people. Included is a grade card which enables one to score himself and/or other employees on all the various attributes and abilities that make up today's "production team." **Circle Inform-A-Gram No. F8.**

"Manual of Record Storage Practice," complete with suggested retention periods, tells what commercial and industrial firms and financial institutions are doing on the subject of record storage practices. It is based on the actual methods of a cross-section of American business. The manual discusses how a record is created and the organization of the file department. Then the booklet talks about transferring methods, the importance of indexing in storage filing and the destruction of records. Also given is a schedule for retention of business records, aphabetically arranged. One section is devoted to showing products available for efficient record storage. Copies of the manual are supplied by Bankers Box Co., 720 S. Dearborn St., Chicago 5, or — **Circle No. F9.**

"Safety at the Norton Company" summarizing the company's safety program for its employees, has been published by Norton Co., Worcester 6, Mass. Discussed briefly are the causes of accidents and how the program operates to eliminate hazards. The booklet covers such subjects as available protective equipment, machine guards, fires, plant housekeeping, etc. A pocket in the back cover has been provided to keep envelope stuffer type bulletins which have been issued to employees periodically. A limited number of copies are available for persons interested in preparing a similar booklet within their own companies. **Circle Inform-A-Gram No. F10.**

MOORE SPECIAL TOOL COMPANY

Holes, Contours, Surfaces

Published in the interests of greater accuracy and quality in the toolroom and on the production line by the Moore Special Tool Co., Inc., Union Ave., Bridgeport 7, Conn., builders of Jig Borers, Jig Grinders, Panto-Crush Wheel Dressers, Precision Rotary Tables, Motorized Centers and a complete line of Hole Location Accessories.

New 424-page Book Tells How You Can Produce Tools, Dies, Precision Parts the Modern Way...

"Holes, Contours and Surfaces" Just Published

EXCLUSIVE... 184 pages of Woodworth Hole Location Tables

"HC&S" includes a 184-page section of Woodworth Circular Tables which greatly simplify calculating rectangular coordinates for locating hole centers on a circular layout. There is a table for each pattern of holes, 3 to 100 inclusive. Unavailable elsewhere, these tables alone are worth more than the price of the book.

495 Photos and Drawings

"HC&S" features a multitude of close-up instructional photographs, working drawings and charts placed adjacent to text so that it can be followed photographically.

"Holes, Contours and Surfaces," just published by Moore, is the first comprehensive book that gives all the answers to metalworking's toughest problem: *the accurate locating and machining of holes, contours and surfaces.* It covers the many major developments in the field since 1946 when Moore's first book, "Precision Hole Location," was published. That book was so well received that it became a technical best-seller and is now out of print.

While "PHL" dealt only with jig boring and jig grinding of holes, this new, 424-page volume describes subsequent hole-location developments, covers contours and surfaces, and introduces the subject of linear form grinding. "HC&S" is a must for every toolmaker, jig borer operator, jig grinder operator, machinist, tool engineer, production engineer, machine buyer, machine builder, production executive, product designer, apprentice and student.

"HC&S Fills Urgent Need" .... Burnham Finney

Here's what Burnham Finney, distinguished editor of *American Machinist*, says about "HC&S": "Outstanding for its clarity of expression, its technical accuracy... fills an urgent need and should live long on the bookshelves and work benches of the American Metalworking Industry."

14 Fact-Filled Chapters

1. The Problem of Location
2. Improvised Location Equipment & Methods
3. The Foundation of Accuracy
4. Engineered Location Equipment Standards
5. The Coordinate Locating System
6. Jig Boring Principles & Applications
7. Jig Boring Practices
8. Jig Grinding Principles & Applications
9. Jig Grinding Holes
10. Jig Grinding Contours
11. Linear Form Grinding Principles & Applications
12. Linear Form Grinding Practices
13. Inspection Methods
14. Precision Pays Dividends

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The Sperry Hydraulic Control, a self-contained system, consists essentially of a hand-actuated transmitter and a receiver connected by a single tube. There is absolutely no dependency on outside sources of power such as electricity or air which are subject to failures. The system is filled with hydraulic oil, and due to the oil's incompressibility, force applied to the transmitter is immediately delivered to the receiver. Any movement of transmitter handle is duplicated by the receiver lever. The Sperry Hydraulic Remote Control System makes possible precision operation of a remote mechanism, free of backlash and the "sponginess" of the ordinary pneumatic control. The operator is assured of instantaneous response, extreme accuracy and "feel" of the operated mechanism even though it is often out of sight and many feet away. Simple and inexpensive installation complete the features appreciated by all in industry.

SPERRY HYDRAULIC CONTROLS are for manual or automatic control of:

Brakes	Hydraulic Pumps	Fire Extinguishers
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Throttles	Engine Spark Adjustments	Grinder Spindles
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Valves	Variable Speed Transmissions	Releases
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Write for more complete information.

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DANBURY, CONNECTICUT

CIRCLE INFORM-A-GRAM KEY NO. 166

Presenting . . . Representing . . .

Frank W. Taylor Co. is serving as sales representative for the line of AC and DC subfractional, servo and gear motors; fans; blowers and dynamotors produced by Induction Motors Corp. of Westbury, L. I., N. Y. The Taylor organization will cover New York, New York City and Long Island.

In furtherance of its plan to establish nationwide distribution for oxide cutting tools, Diamonite Products Mfg. Co., a division of U. S. Ceramic Tile Co., Canton, Ohio, has made known the appointment of sales representatives in Arizona and the St. Louis area. They are Harwood Industries in Phoenix, Ariz., and Carbide Engineering Service in Jennings, Mo.

In line with an expanding national sales campaign, Industrial Gear Manufacturing Company of Chicago, has appointed J. A. Schaefer as West Coast sales representative. He will headquarter in San Mateo, Calif. Mr. Schaefer will also represent Wisconsin Centrifugal Foundry Company and Dahlstrom Machine Works.

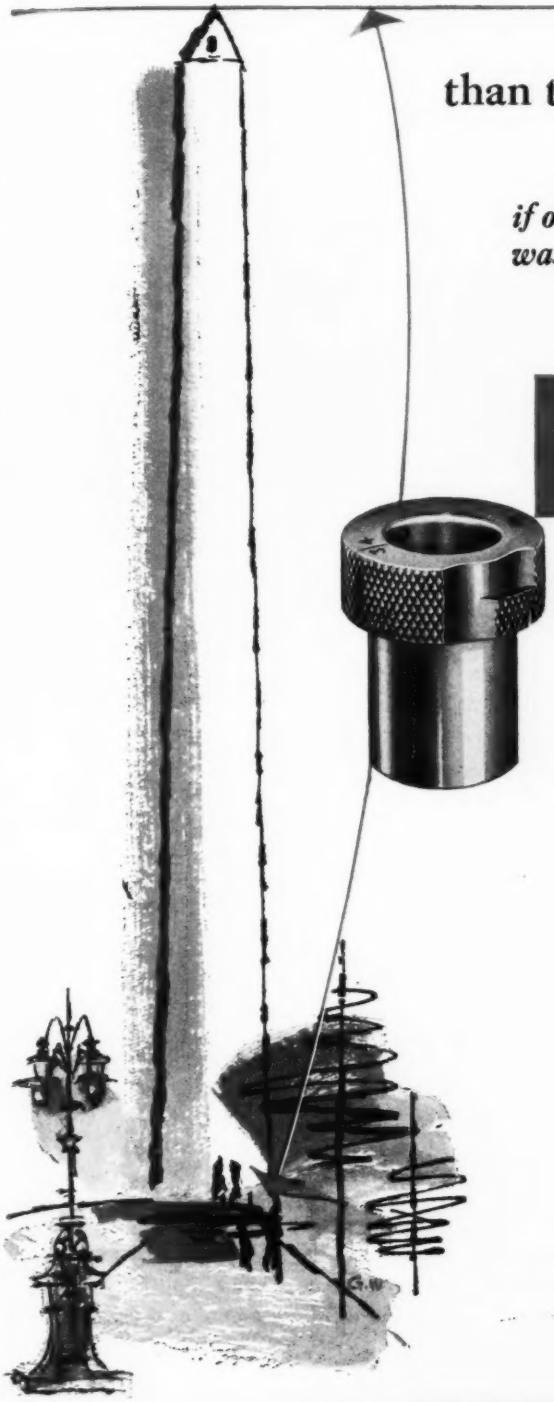
The appointment of Jack McLaughlin Associates as representatives for Nylok-Detroit Corporation has been announced. McLaughlin Associates will handle Nylok-Detroit's complete line of standard and special self-sealing, self-locking Nylok processed parts.

The Enos & Sanderson Company has been named distributor for western New York by Electro Refractories & Abrasives Corporation. Electro Refractories manufactures abrasives as well as special refractories and related products.

Joseph P. Foley has been appointed by Baldwin-Lima-Hamilton Corporation to handle sales of SR-4 strain gages, devices and systems. In addition, he will handle other electronic equipment produced by the B-L-H Electronics and Instrumentation Division. Mr. Foley headquarters in Cleveland.

Mill Supply & Machinery Company has become a distributor in southern Illinois and eastern Missouri for Greaves Machine Tool Company, a division of J. A. Fay & Egan Company. Greaves specializes in the manufacture of plain and universal milling machines, production machining, special machine tools, and all types of gears.

More than 10 times taller



than the Washington Monument:

if one of each size in stock was placed end to end, of

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- Only ACME offers you *TWO* standards: A.S.A. and ACME—#80 to 2″.
- Standard sizes from your local distributor's stock—special sizes on request.
- Standard catalog tolerances.
- FREE catalog and price list.

Write your distributor or Acme for information and prices on micro, standard and tungsten carbide drill jig bushings.

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IT OSCILLATES!
ADJUSTABLE FOR OSCILLATING FREQUENCY AND LENGTH OF STROKE
HAMMOND OSCILLATOR
SPECIALLY DESIGNED FOR USE WITH
NEW ANOCUT ELECTROLYTIC GRINDING PROCESS
• CUTS DIAMOND WHEEL COSTS
• GRINDS FASTER
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NEW Hammond ELECTROLYTIC OSCILLATING CARBIDE TOOL GRINDER

Write FOR CATALOG

The *New* Hammond Oscillating Carbide Tool Grinder was designed primarily for use with the Anocut Electrolytic Grinding Process. It can also be used for conventional grinding without the Electrolytic "Power Pack".

A controlled and precise method, the Electrolytic process removes stock electro-chemically. It is *not* to be confused with electro-spark or electro-arc methods. It reduces diamond wheel consumption 80 to 90%.

Outstanding feature is the precision, dynamically balanced, OSCILLATING spindle... with *variable* oscillations per minute and *variable* length of stroke. The operator no longer oscillates the tool . . . the wheel does the work, with greater speed, smoothness, accuracy, and less physical effort.

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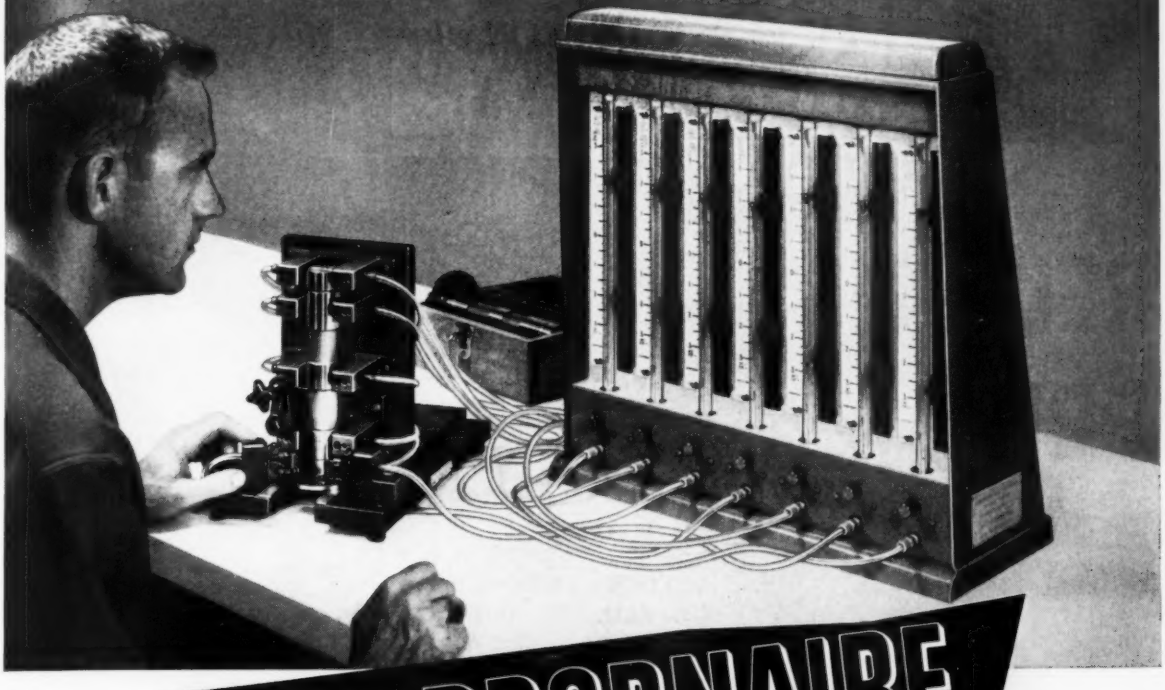
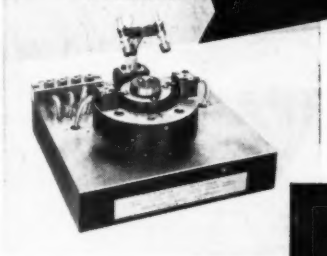
Speed Inspection
OF PRODUCTION PARTS!



NEW DEARBORNAIRE
MULTIPLE COLUMN AIR GAGING INSTRUMENTS



Special Air Gaging Fixtures designed and built to meet your particular application requirements. Complete engineering service available upon request.

Send part print showing all dimensions to be checked and tolerances required for prompt quotation and delivery.

To speed inspection of production parts, new Dearbornaire air gaging instruments are now offered in multiple column units designed to permit more accurate simultaneous checking of as many dimensions as may be required for a given part. What's more, each unit incorporates all of the advanced design features which have made Dearbornaire the most practical, most versatile column type instrument ever produced . . .

- New higher rated pressure system and built-in circuit restrictions make them virtually self-cleaning, reduce maintenance to a minimum.
- New glass tube has a characterized internal taper which provides positive linear accuracy over the full extent of the calibrated scales.
- Easy-to-read Zero-centered scales permit use of instrument for normal inspection, statistical quality control, and as a tool setting gage.
- Interchangeability of component parts simplifies conversion from one amplification to another, reduces spare parts inventory costs.

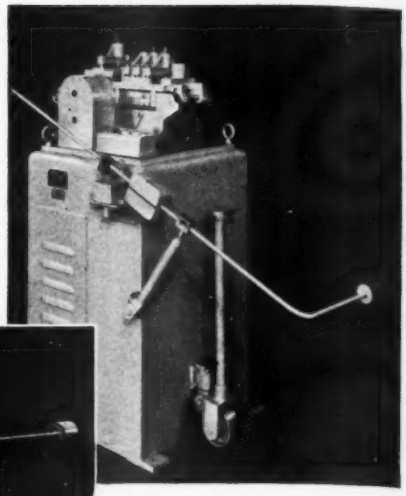
Plus a complete line of air gage spindles, rings, snaps and cartridges all precision finished to give you greater accuracy, longer wear life. Free demonstration arranged upon request. Write for details today!

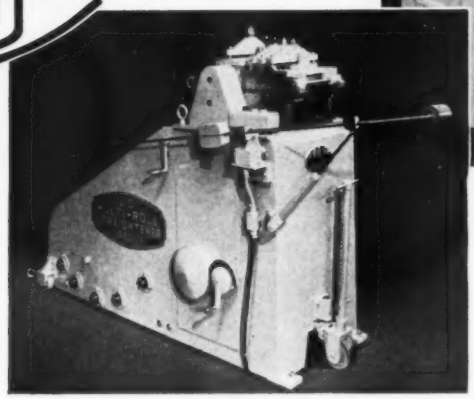
AIR GAGE DIVISION
DEARBORN GAGE COMPANY
22038 Beech Street • Dearborn, Michigan

USE U.S. PRODUCTS ★

REDUCE PRESS ROOM COSTS

Right: Model PDS-4½ U. S. Power Driven Straightener (portable type) for material up to 4½" wide, ⅛" thick. Equipped with ½ HP variable speed drive motor. Also made in other sizes.





Left: Model PDS-940 U. S. Combination Coil Cradle and Power Driven Straightener (portable type) for material up to 9" wide, ⅛" thick, coils with OD up to 40". Includes 2 HP variable speed drive motor. Also made in other sizes.

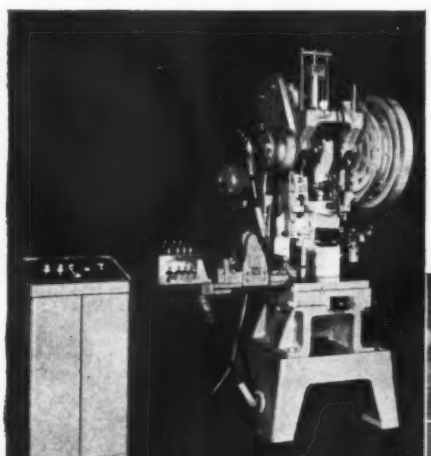
Don't allow inefficient operations to devour your profit margin. U.S. Automatic Press Room Equipment is designed and built to help you effect savings in the production of stampings.

The use of coil stock in your punch press operations should result in very definite savings, and these savings can only be completely assured by using automatic equipment in conjunction with your presses. The illustrations show just a few of the many different units included in the U.S. line for the efficient feeding, straightening and holding of coil stock.

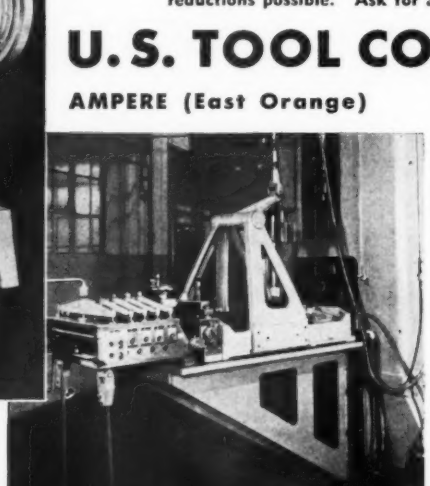
Investigate to see if you are effecting all the cost reductions possible. Ask for a copy of Bulletin 80-P.

U.S. TOOL COMPANY, INC.

AMPERE (East Orange) NEW JERSEY



Above: Model SF-12 U. S. Mechanically Driven Slide Feed with Plain Straightener for material up to 4½" wide. Shown mounted on a Minster B1-32 High Speed Gap Press.



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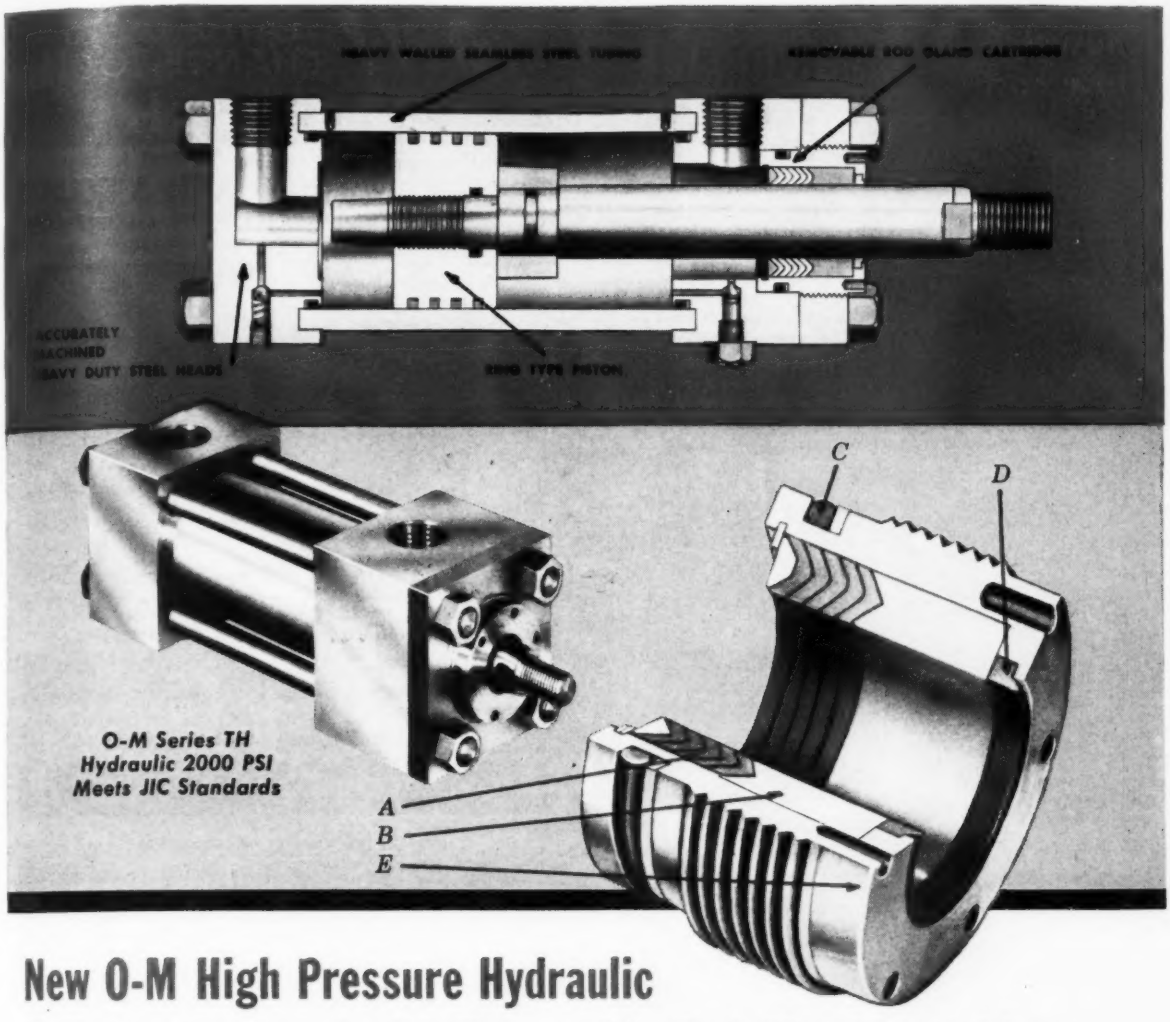
Die Sets
Multi-Slides ®
Multi-Millers ®

Left: Model SF-24-24 U. S. Mechanically Driven Slide Feed with Plain Straightener for material up to 24" wide. Shown mounted on a Straight Side Press.

CIRCLE INFORM-A-GRAM KEY NO. 170



New O-M High Pressure Hydraulic Cylinder equipped with Removable Rod Gland Cartridge

The O-M-engineered removable Rod Gland Cartridge, exclusive with the O-M Series TH Hydraulic Cylinders, incorporates all the features essential to peak performance and minimum maintenance. It is constructed with a heavy wall steel shell threaded for quick, easy removal, and accurately piloted in rod head to assure perfect alignment. In most applications cartridge can be removed easily without removing mounts or the rod nuts. You simply loosen and remove with a spanner wrench.

A ***Rod Packing*** — Vee type, non-adjustable, self-compensating, rod gland packing provides multiple lip seal with excellent pressure sensitivity and long life.

B ***Rod Bearing*** — Extra long, bronze rod bearing provides large bearing surface located well forward for maximum support of piston rod.

C ***Cartridge "O" Ring Seal*** — With leather back-up washer provides positive seal and acts as friction lock to retain cartridge.

D ***Rod Wiper*** — Homogeneous lip type located well forward to prevent accumulation of dirt in pocket. Metallic scraper (AN approved) available and interchangeable with wiper.

E ***Pilot*** — O.D. of cartridge serves as pilot for cylinders mounted on rod end.

O-M Series TH High Pressure Hydraulic (oil) Cylinders — conservatively rated at 2000 P.S.I. — are available in bore sizes 1½ to 8-inch inclusive. Descriptive drawings of cylinder, mounts, mounting brackets and capacity chart are included in the new O-M Bulletin 105. Mail coupon for your FREE copy today.

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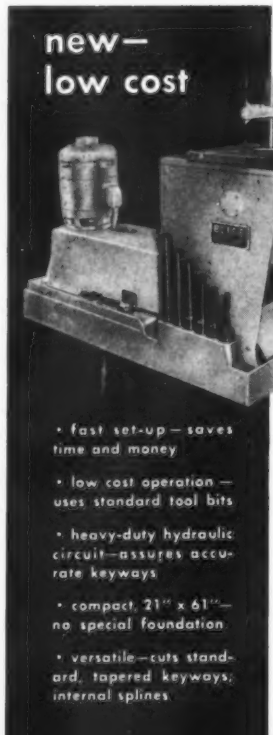
new—
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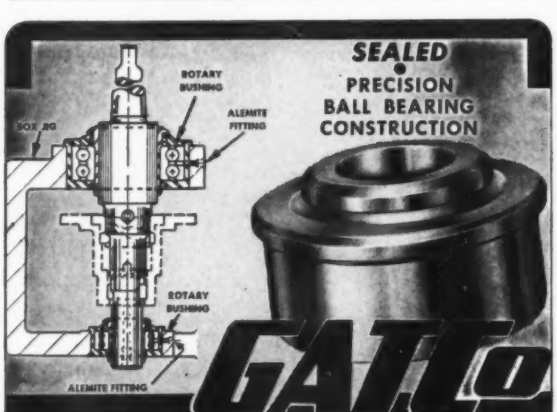

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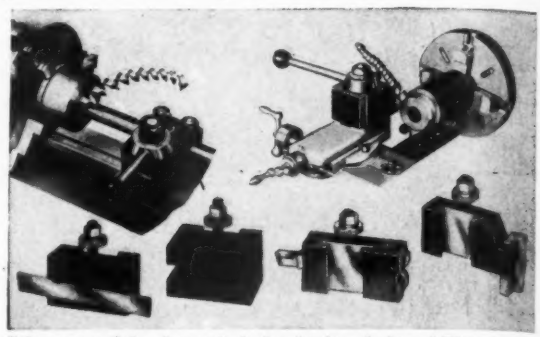

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CIRCLE INFORM-A-GRAM KEY NO. 1724

J & L Tools Up Engineering Groups 'For Action'

The engineering activities study and resultant "scheduling program" are promoting greater efficiency of engineering operations for each branch of Jones & Lamson Machine Company's engineering groups, John E. Barbier reported to the Management Division of the American Society of Mechanical Engineers recently.

"We took the attitude," said Mr. Barbier, J & L Staff Manager of Engineering, "that unless we were making the best possible use of our engineering talent, facilities and supervision, we were liable to have less than desirable results from our entire operation."

The program started with an inventory of engineering operations and a review of how engineering functions are tied in with the other functions of the company's operations. Several methods of analysis were used. Each supervisor, plant wide, answered a comprehensive questionnaire, "designed to secure an understanding of his basic function, the scope of his operations, his general objectives and responsibilities, specific duties broken down by hours per week required, and the degree of authority he felt he had in each instance."

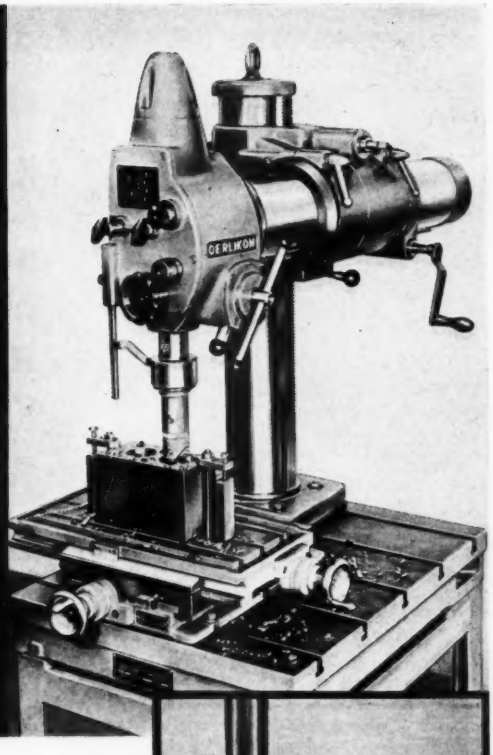
"A technical employee analysis of a simpler nature reviewed what each man did daily, weekly and monthly in the discharge of his regular and special duties," said Mr. Barbier.

Time was then spent in exploring and investigating simplified and standardized practices and procedures in use elsewhere, and their effectiveness in other plants. "We found out about many things in this manner," said Mr. Barbier, "which we could use to good advantage." Work flow charts, in some cases very complex, were prepared to determine the necessity of present actions and if the manner of handling could be improved.

Most important result of the program was the establishment of a "scheduling program" for each branch of the company's engineering groups. Product development, special tool engineering and the technical aspects of sales engineering, according to Mr. Barbier, are now on-schedule.

Scheduling procedure is handled by group supervisors and is based on the productive requirements of the group or department. These are revised weekly to reflect current "work inventory" and the group's plans. They are distributed weekly to marketing, manufacturing and other interested engineering groups "to keep all concerned currently advised of each

OERLIKON
UB 2
ALL ANGLE PRECISION BORER



The UB 2 performs hundreds of general and specialized workshop operations—drilling, milling, countersinking, tapping, precision and center boring, reaming, facing, trepanning, etc.

- Radial swivelling arm combined with a freely swivelling head, allows handling of any job—even in awkward positions.
- Boring head can be canted to any angle (360°) and latched accurately in the vertical and horizontal positions.
- Spindle speeds variable from 30 to 3070 rpm.
- Travel of quill 6" with 3 powered feeds.
- A compound table for coordinate location makes the UB 2 a most useful tool room machine.
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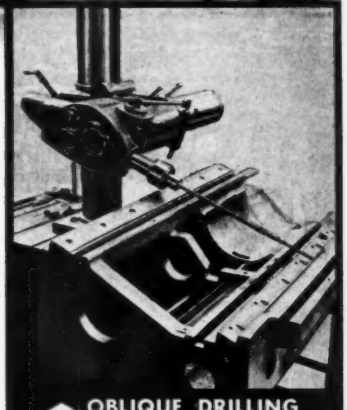

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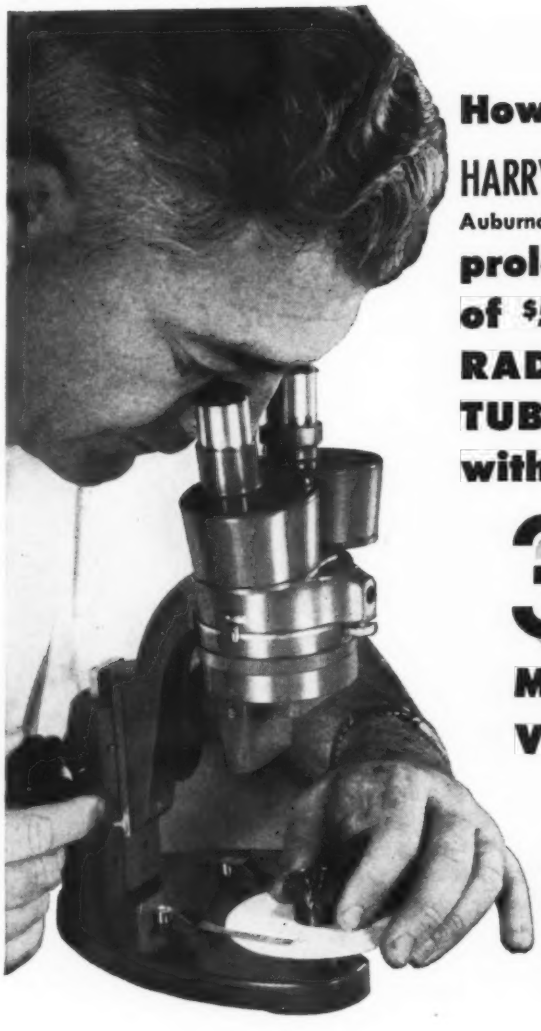
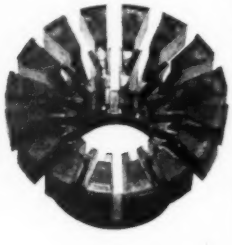


How HARRY WOLFF Co., Inc. Auburndale, Massachusetts prolongs life of $5000 RADAR TUBES with 3-D MICRO-VISION



A tiny burr on this tuning crown will burn off at normal operating temperatures and cause radar tube failure. Precision components like this are made of metals that cost over $100 per pound. The tube costs up to $5000. Obviously, rejects and failures are prohibitively costly.

That's why Harry Wolff Co., Inc., uses Bausch & Lomb Stereomicroscopes to check 368 different edges of each tuning crown. Inspectors see the work right-side-up, clearly magnified in vivid 3-dimensional detail. Burrs are quickly revealed, and easily scraped off.

And that's why Harry Wolff, president, says: "We consider the B&L Wide Field Stereomicroscope as important to us as a precision lathe."

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group's situation." These "work-load indicators" anticipate engineering bottlenecks well in advance of their occurrence. "Necessarily," Mr. Barbier explained, "they are flexible, but because they are revised weekly, maintaining flexibility is no problem."

Job descriptions and authority manuals were additional fruits of the J & L study. About 80% of occurrences are covered in the manuals, and the material included is based primarily on results of the early questionnaires.

Still another result of the study was the revision of the organizational arrangement of the engineering departments. They now are set up vertically by products, with a Product Manager of Engineering. The company also has established an "Engineering Services" group — a drafting pool — where most of the firm's detailing and checking is done. The manager of this group reports to the line manager of engineering and requests for service come directly from the product engineering groups.

In sales engineering, procedure was revised so that the engineers now handle technical functions only. A great deal of the customer contact and clerical work formerly handled by engineers is being done by marketing, order and accounting groups. Thus, engineering talent is saved for engineering use.

To sell everyone on the program and the changes being made, the company instituted a series of "Engineering Instruction Courses." Simplified Drafting courses also were given to acquaint engineering employees with the practices found in the early survey to be feasible. Various training programs are being continued by Jones & Lamson in an effort to keep the engineering groups fully informed on technical advances.

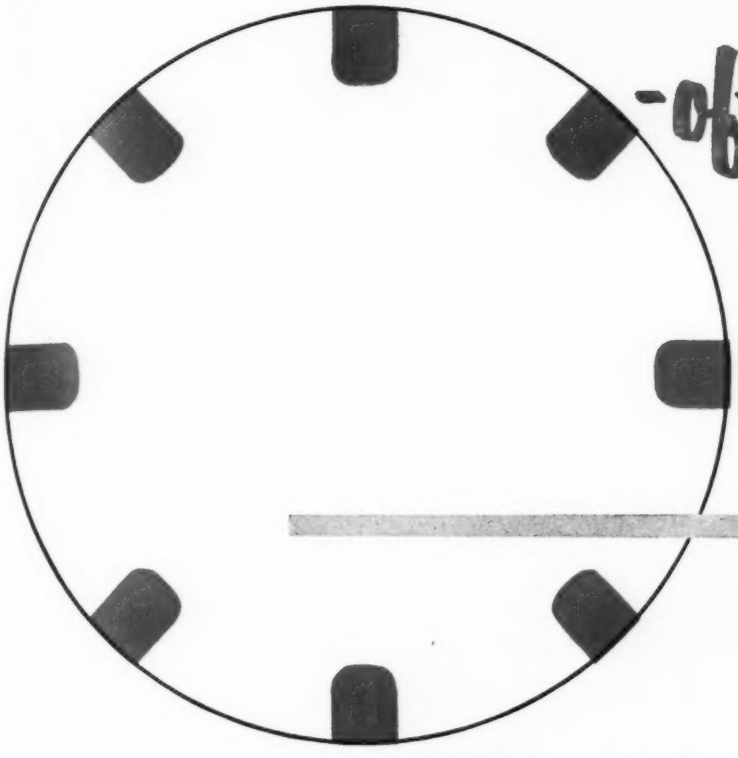
SCALES BUILT INTO CRANE REDUCES WEIGHING TIME

Scales built right into its materials handling crane save more than 40% of the time used in weighing materials for inventory control at the Ellenville, N. Y., plant of Channel Master Corporation, makers of television antennas and accessories.

In fabricating aluminum tubes for TV antennas and lawn furniture, Channel Master uses a three-ton Conco traveling crane to move tubing bundles from one processing bay to the next.

By installing Baldwin SR-4 crane scales between the crane boom and the load and equipping the cab with a meter which indicates the weight of the materials, Channel Master

SIMPLE WAY TO CUT MACHINING COSTS

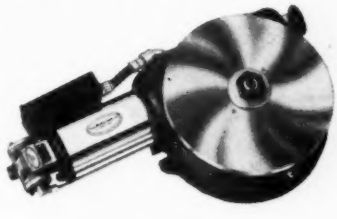


-often in half!

Suppose it takes x-seconds to machine a part. 3x-seconds to get the part to and from the machine tool. Cut 1x-second off handling time—you've cut machining costs in half.

Obvious, you say.
The trick is how.

Here's one way: Install a Bellows Rotary Work Feed Table. Your operator loads at one station while machining goes on at a second, parts are ejected at a third. The table is adjustable to position 4, 6, 8, 12, or 24 stations. It is air-powered electrically-controlled. The ten inch diameter table top can be drilled and tapped for mounting jigs and fixtures or for mounting oversize table tops. The table can be synchronized to the movement of drill press spindles or press rams. It is inexpensive to buy, inexpensive to install and can be readily moved from one machine to another. Simplest way you ever saw to save money in many machining operations.



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Describes the full line of Bellows Rotary Work Feed Tables and Bellows Index Tables: permissible loads, positioning speeds, positioning accuracy. Ask for Bulletins RT-1022 and RT-1326. Address Dept. TP-257, The Bellows Co., Akron 9, Ohio. In Canada: Bellows Pneumatic Devices of Canada, Ltd., Toronto, Ontario.

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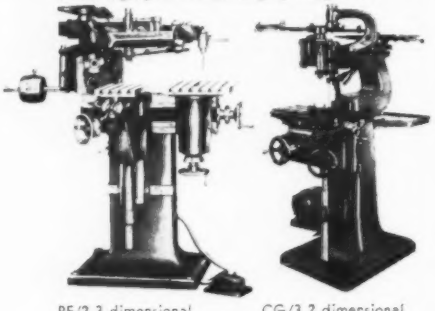

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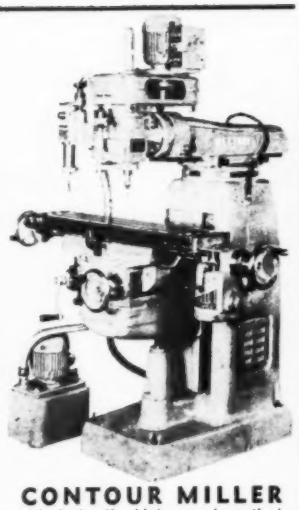

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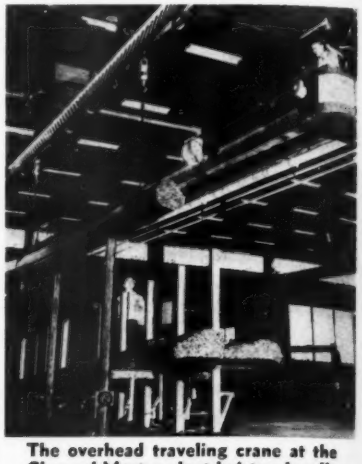
takes inventory control records at the same time that the materials are moved.

Formerly, the crane picked up a bundle of tubes at one processing

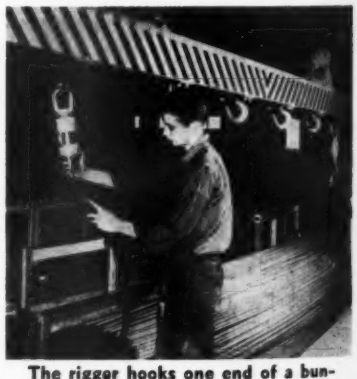


The overhead traveling crane at the Channel Master plant hoists a bundle of tubing. The two crane scales can be seen hanging from the boom.

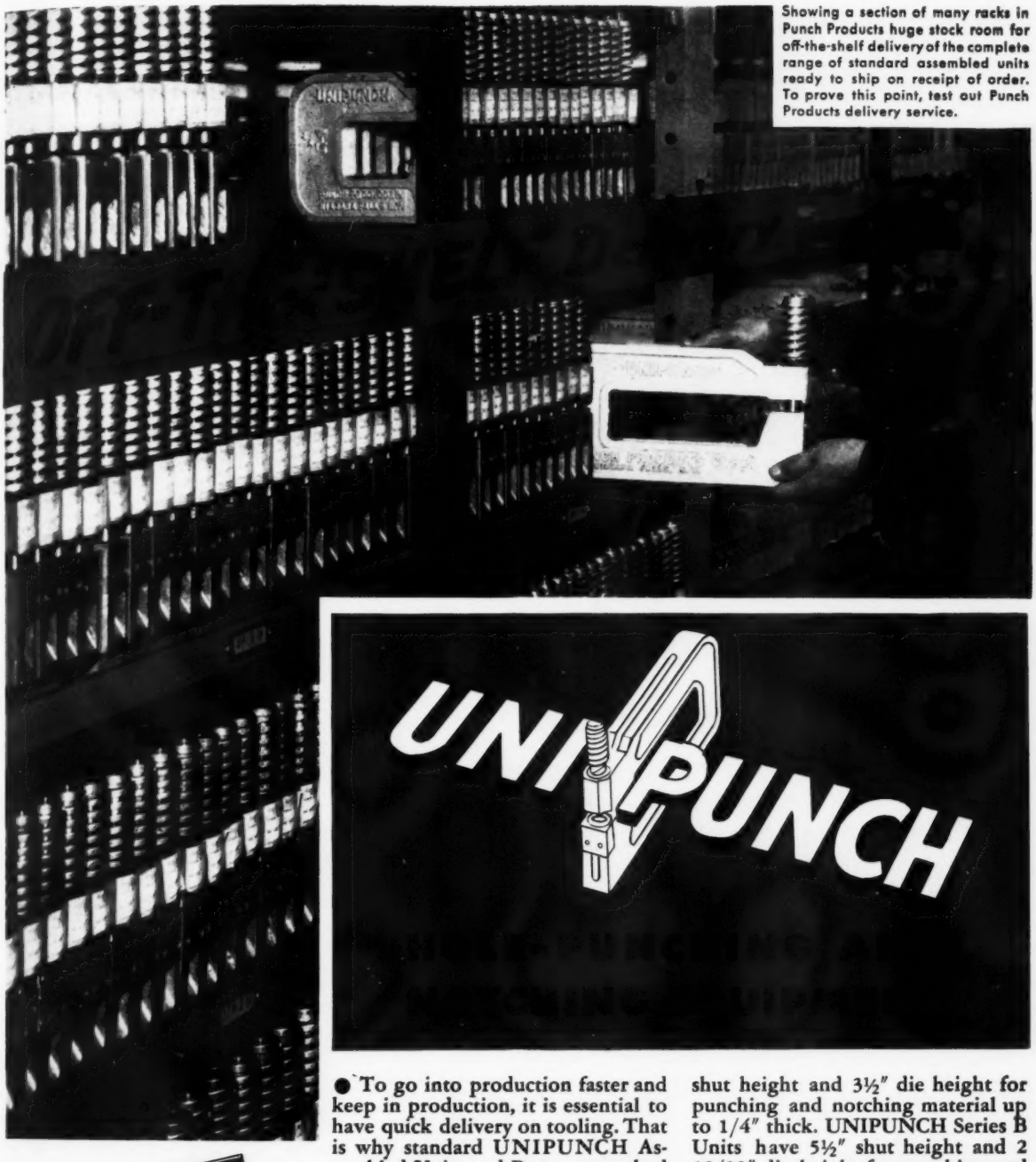
point, ran it to platform scales, lowered it to position where the tubes were balanced and weighed, then picked up the bundle and delivered it to the next processing point. Channel Master estimates that each of the two or three times the tubes were weighed during processing, it lost about three minutes of production time.

Under the new system, weight is taken in half a minute. The crane operator lifts the bundle of tubing at one department, pauses when it is clear and reports the readings on the scale dial in his cab to the rigger who records the weight on the job ticket and punches it on a tag attached to the bundle. The tubing is then moved directly to the next processing department.

Two SR-4 crane scales having a capacity of 2500 lbs, made by Baldwin-Lima-Hamilton Corporation, Waltham, Mass., are used to weigh the tubing bundles on the fly. The crane scales are attached to



The rigger hooks one end of a bundle of aluminum tubing to one of the crane scales made with Baldwin SR-4 load cells. The other scale is already attached.



Showing a section of many racks in Punch Products huge stock room for off-the-shelf delivery of the complete range of standard assembled units ready to ship on receipt of order. To prove this point, test out Punch Products delivery service.

UNIPUNCH

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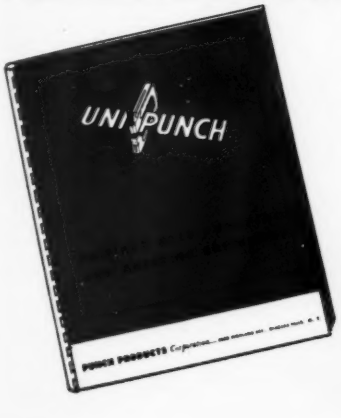

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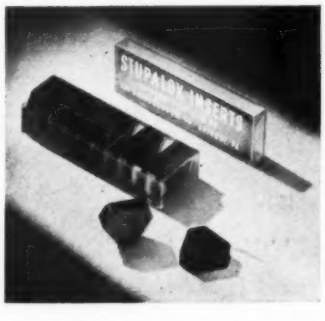
Stupalox tools are available in several styles and sizes of inserts, and in commercial quantities. We will be glad to send you specific information on experiences with Stupalox for machining a wide variety of ferrous and non-ferrous metals.



HANDY PACKAGE...
This compact plastic box contains ten Stupalox sintered oxide tool inserts.

STUPAKOFF DIVISION OF
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hooks on the crane boom by their top rings and the lines with which the bundle is lifted are attached to the hooks at the bottom of the units. The full weight of the tubing — from 1000 to 2000 lbs/bundle — is carried by the Baldwin SR-4 scale units.

The crane scales communicate the weight, through electric cables, to the scale dial in the cab of the crane operator, where the weights registered on the two load-cells are automatically added, the tare weight of lifting cables and hooks deducted, and the net weight reported on the dial.

The 20′ boom, which hangs from the crane hook, is made of two channel-irons bolted back-to-back and equipped with 10 hooks. These hooks permit the rigger to move the load-cells to adjust for the variations in length — from 4′ to 28′ — of tubing handled.

SPECIAL TRANSFER MACHINE UTILIZES STANDARD UNITS

Complete machining of air conditioning housings from rough castings to assembly is now accomplished by a Cross Transfer-matic at a production rate of 18 pcs/hr.

The new machine, built by The Cross Co., Detroit, performs 159 operations: six milling, six boring, one facing, 81 drilling and 65 tapping.

Two-position, progressive type, palletized work holding fixtures carry the parts from station to station.

To provide for flexibility in part design changes, replacement and repair, Cross building block construction was used. All machine parts, even tooling details, are made to interchangeable tolerances for fast and easy maintenance.

Other features of the Cross Transfer-matic include construction to JIC standards; hardened and ground ways; hydraulic feed and rapid traverse for milling, drilling and boring; individual lead screw feed for tapping; automatic lubrication and automatic chip conveyor.

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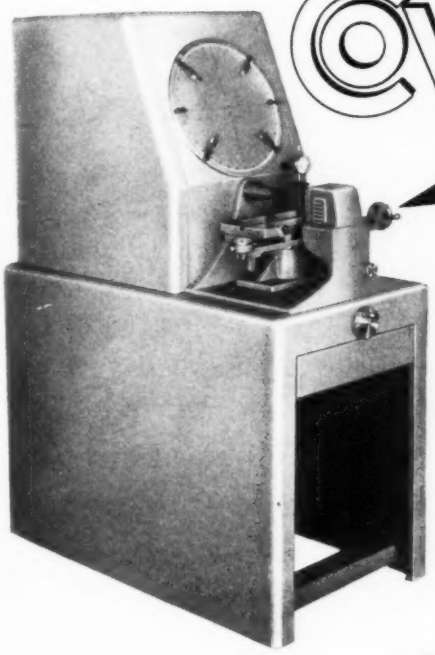

COVEL Optical Comparator

Only $985.00

Now every shop can enjoy the advantages of precision optical gaging and inspection. Covel No. 14 Optical Comparator outmodes mechanical checking methods, prevents costly errors, saves time and money!

The Covel Comparator is easy to use, even in brightly lighted shop areas. Has large 14″ diameter screen and 6″ horizontal stage travel. Rugged, precision construction throughout.

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COVEL PRECISION GRINDERS
BENTON HARBOR, MICHIGAN

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New Clark ADJUSTABLE COUNTERBORE and SPOT-FACER

handles large diameters!

Fastest cutting, adjustable, large diameter spotfacer on the market! Takes heavy cuts without chattering by means of unique shearing action—no digging, no gouging! M3 high speed steel blades, adjustable for diameter or can be reset to size after grinding. Blades easily modified for special purposes. Machines steel forgings, heat-treated steels, cast iron, titanium, stainless, aluminum alloys, etc! Use this new Clark Adjustable Spot-Facer and Counterbore in MILLS, RADIALS, DRILLS, TURRET LATHES. Uses standard pilots or pilot drills. Straight or Morse tapered shanks.

Robert H. Clark Company
9330 Santa Monica Blvd., Beverly Hills, Calif.

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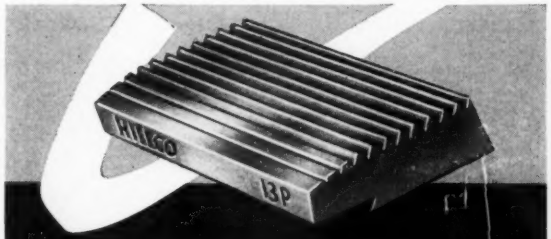

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A NEW NAME FOR AN OLD ESTABLISHED PRODUCT

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This complete line of tangent chasers is now known as "HILLCO". "HILLCO" tangent chasers can be reground for 80% of their original length. The same precision and long wear are guaranteed that have made our chasers a standard through 75 years of cutting tool manufacture.

HILL ACME TOOLS FOR INDUSTRY

THE HILL ACME COMPANY
ACME MACHINERY DIVISION
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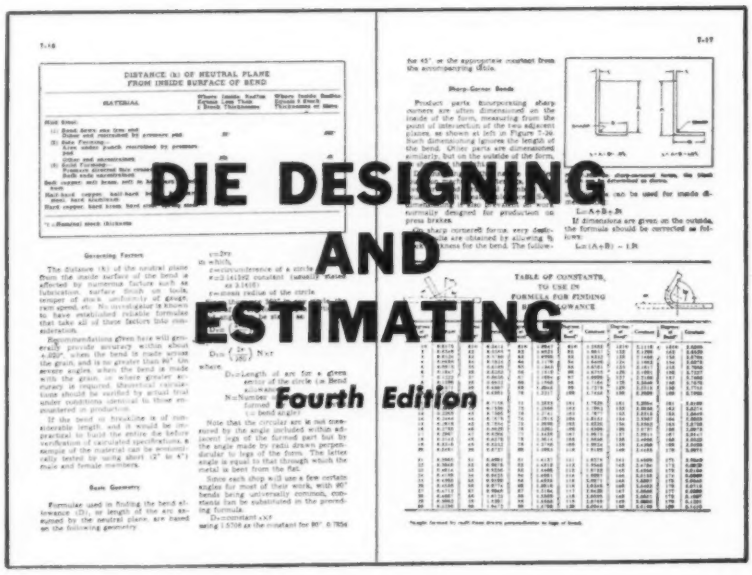

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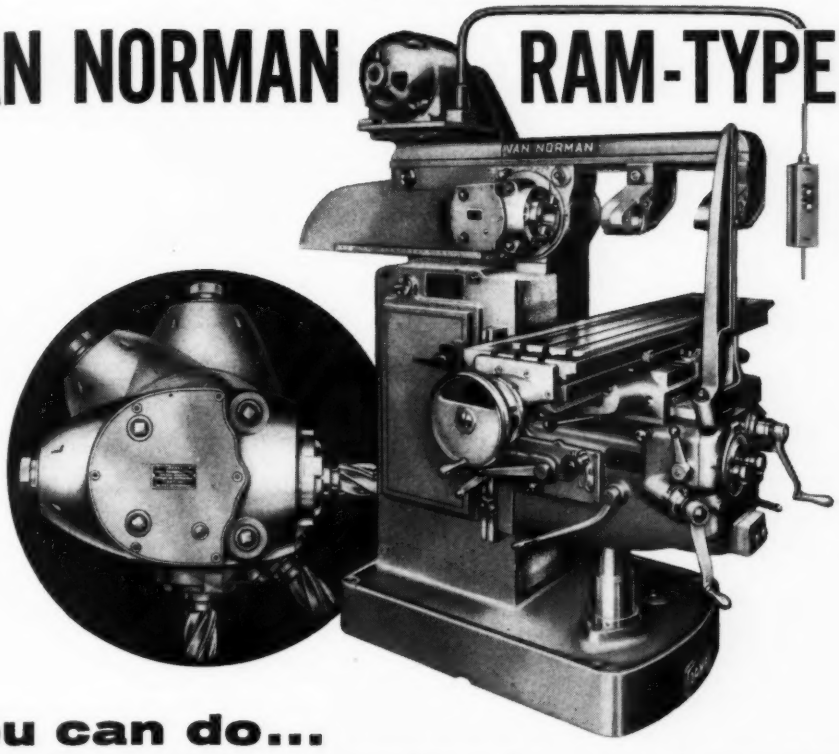
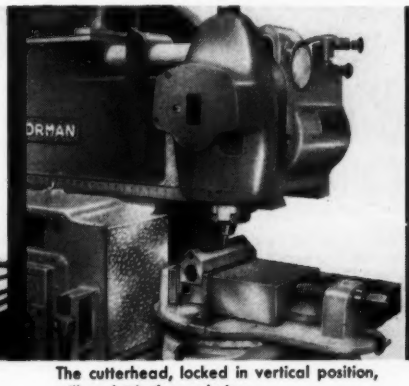


You can do...

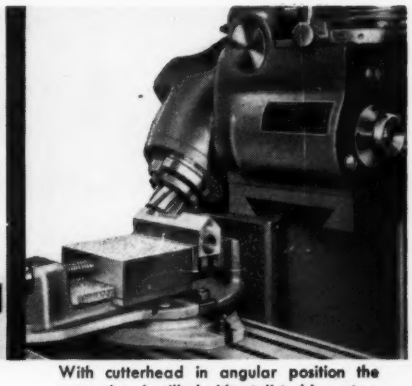
HORIZONTAL, VERTICAL, ANGULAR MILLING

WITHOUT ATTACHMENTS

A typical horizontal milling operation performed on the 24MA.



The cutterhead, locked in vertical position, mills a slot in the workpiece.



With cutterhead in angular position the same piece is milled without disturbing setup.

One investment in *one* Van Norman ram-type miller gives you the equivalent of two conventional machines plus attachments. In addition to important savings on the investment, you also get big dollar savings through reduced work setups, idle machine and operator time and increased production.

Don't wait . . . for extra profit install a Van Norman machine now! They are available on many purchase plans . . . Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate up to 10 years. Conditional sales contracts not available to Export.

VAN NORMAN MACHINE CO.

SUBSIDIARY OF VAN NORMAN INDUSTRIES, INCORPORATED

SPRINGFIELD 7, MASS.

Get complete details on the Van Norman 24MA, or on any of the many Van Norman ram-type millers. Write, wire or telephone for catalog.

CIRCLE INFORM-A-GRAM KEY NO. 181

PLASTIC JIGS AND FIXTURES FOR SHORT RUN OPERATIONS

Savings of up to 85% in the first cost of vise jaws, mill fixtures, and drilling chucks have been made by Smith Welding Equipment Corporation, Minneapolis, since the company started making its own tools from Rezolin Toolplastik compounds based on Bakelite epoxy resins.

The company is broadening its lines with a number of new products. This means that design improvements are frequent and production runs between changes are short. Tooling costs in such an operation can become prohibitively expensive. By switching to epoxy, the company has not only cut tool costs but it has also been able to reduce production downtime and introduce tooling into areas where specialized equipment was prohibited by high cost.

Production of the company's Pipeline cutting assembly provides an example of how plastic tools are used. Nine of the 13 operations required to produce this critical part employ plastic tools. Figuring labor and direct overhead at $5 an hour, the Toolplastik jigs, nests, and jaws cost $751.90, less than half the price of conventional tools from a vendor.

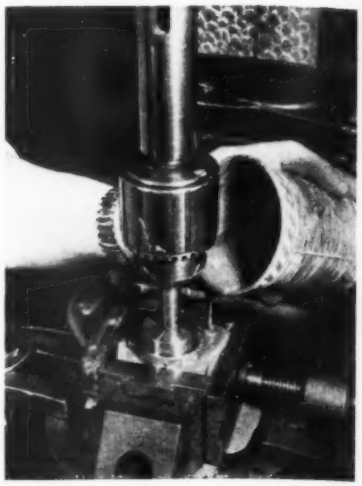


Figure 1

The new plastic tools are made, in place, on idle equipment using an actual part as a section of the mold so that there is never any question of a part fitting the tool. It takes about half an hour to line up and pour the resin (Fig. 1).

Figure 2

Practically anyone familiar with tooling processes can learn to use the material in a short time. The compound hardens overnight. Bakelite epoxy resins are used in Toolplastik compounds because they can be formed without pressure and will cure to extreme hardness without applied heat. Epoxy tools can be used even in tough applications such as on a machine that requires five matched pairs of chucking jaws (Fig. 2).

. . . Continued on Next Page

J&L

MODERN-MAGIC CHUCKS & COLLETS

Change tools on the run . . .

- Give multiple spindle output to single spindle machines
- Add extra stations to turret lathes
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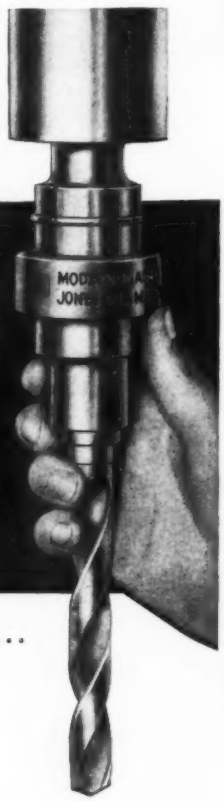

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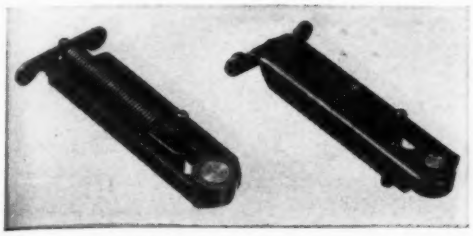
FOR POSITIVE STOCK ALIGNMENT
IN PROGRESSIVE DIES



Amcor Roller Stock Pushers

SPEED UP PRODUCTION with precision-made AMCOR Roller Stock Pushers. Easy, smooth stock feeding, without buckling, assures more production with less operator fatigue.

SAVE MONEY, AMCOR Roller Stock Pushers sell for just a fraction of what hand-made bench models cost to make.

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The AMCOR Roller Stock Pusher is quickly adaptable to any work specifications. Distributors throughout the country stock a complete line of nine models to fit all production needs.

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APPLIED MECHANICS CORPORATION
P.O. BOX A882 GRAND RAPIDS, MICHIGAN
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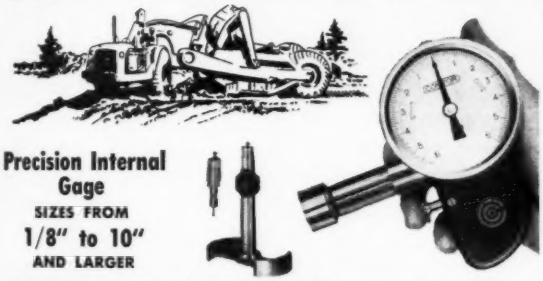
Heavy machinery builders use this gage extensively for Quality Control



Precision Internal Gage
SIZES FROM
1/8" to 10"
AND LARGER

COMTORPLUG with interchangeable expanding plugs to gage simple or special bores from 1/8" to 10" dia.

UNIQUE ADVANTAGES
- Positive gaging accuracy to fraction of .0001" regardless of who operates it.
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- Positive 2-point gaging — automatic centering.
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- A shop tool for all-day every day use.
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Approximately 40 leading road machinery manufacturers employ COMTORPLUGS for precision checks of bores up to 10" diameter, to tolerances in ten-thousandths. IT MAKES PRECISION GAGING EASY . . . at machines . . . at inspection bench . . . for selective assembly. No other like it — investigate and see why.

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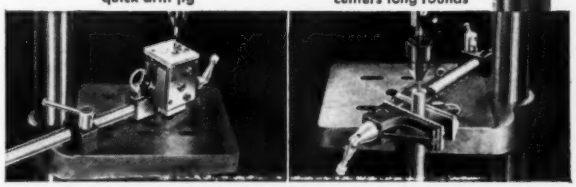
quick drill jig — centers long rounds



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High precision, low cost instrument for 2-dimensional linear measurement. Range 2" x 2", reading to 0.0001".

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Reliable, low cost instrument for linear measurement. Ranges up to 4", reading to 0.0001" or 0.00005".

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High quality, low cost instrument with range up to 0.100". Reading to 0.001", easy interpolation to 0.0002".

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The Gaertner Scientific Corporation

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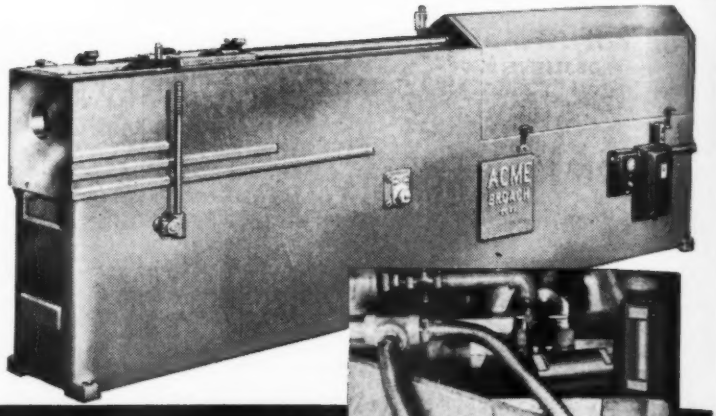

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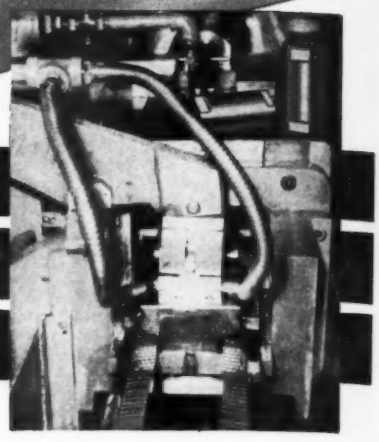

another outstanding success by Acme!

By applying specially designed tooling to a standard Acme horizontal machine, we were able to broach deep flats on one side only of tough steel bushings. . . . Other bushings of various diameters and lengths are broached with opposed flats on each end . . . Change-over may be made quickly so that broaching of small lots is practical. . . . Large bushings with broached flats on one side may be seen at upper right hand corner of fixture cut.

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1" Range reading in 1/10,000"

To attain permanent accuracy at these close limits, highest precision workmanship and exclusive design of mechanism are of Major importance and ONLY found in "MASTER COMPAR"

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Release button for movable Anvils on RIGHT Hand side enables you to hold tool the conventional way.

NEW — Resetting to Zero in 5 seconds

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Stops Losses making Dies and Templates

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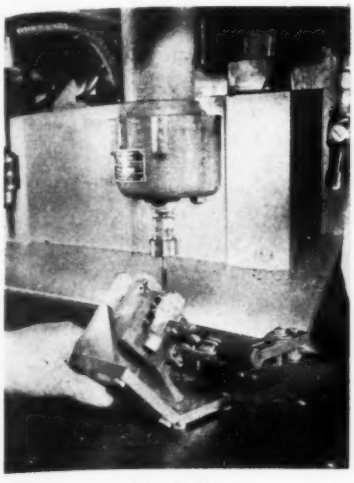
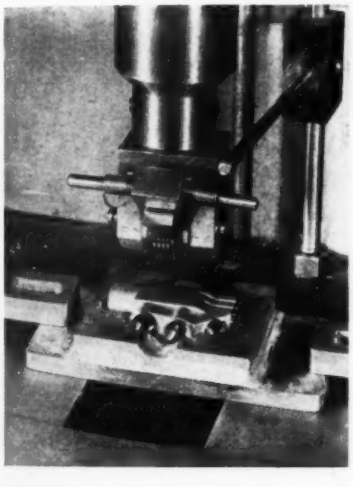


Figure 3

In a drill-press operation, loading times have been reduced through the use of toggle clips instead of screws (Fig. 3). Plastic tooling also eliminates the possibility of mars and nicks on finished parts (Fig. 4).

While plastic tools are considered primarily short-run equipment, they are durable. Smith Welding has chucking jaws which have handled 10,000 parts with no signs of wear.

Figure 4



Pheoll Mfg. Co. has disclosed that Central Screw Co. has been licensed to manufacture Schweppe Studs. The Schweppe Stud is Pheoll's new self-tapping, self-locking and automating stud that speeds assembly and saves cost by eliminating critically drilled and pre-tapped holes.

NEW DRILLING UNIT UTILIZES CAM FEED

A new cam feed drilling unit, embodying numerous new features, incorporates the type of cam that gives the highest percent of efficiency considering rapid approach and return, and with built-in air counterbalance, gives up to 85% of cam surface devoted to metal removal.

This unit developed by the W. K. Millholland Machinery Co., Indianapolis, Ind., retains the plate cam. It is completely enclosed and is lubricated by a Micro-Fog system. This eliminates oil seals on all rotating shafts, permits unit to be mounted in any position and be lubricated completely and automatically. Just ¼ pint of oil per 8 hrs of operation fully supplies all lubrication of the unit.

Linkage and gear segment actuating means to the spindle quill are eliminated in the No. 4000 series Millholland Unit by use of a solid cam roller follower on the spindle

. . . Continued on Next Page

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one of which may be just the one to LOWER YOUR PRODUCTION COST

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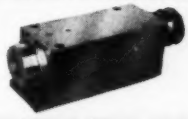
POPE Super-Precision 1 HP, 3600 RPM Motorized Tool and Cutter Grinder Clearance Angle Swivelling Heads provide angular adjustment in a vertical plane. They pay for themselves in time saved. Cup wheels can be used for practically all clearance angles.



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POPE Heavy Duty Boring Spindles assure smooth, chatter free, continuous high production of accurate parts. Belt driven or motorized, in a wide range of horsepowers and speeds.

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POPE Precision Internal Grinding Spindles have the super-precision bearings to withstand both axial and radial loads and to produce better finished ground holes. Their ability to take heavy cuts means increased production. Wheel life is increased, too. For Bryant, Cincinnati, Excello, Heald, Landis and Norton Grinders.

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POPE Super-Precision, High Frequency, Heavy Duty Spindles are available for speeds up to 100,000 RPM. They are unequalled for low cost maintenance, long life, trouble-free operation and rugged ability to cut metal fast.

Send us your specifications and get prompt quotations on the one best Spindle for you out of the 20,000 different Precision Spindles that bear the name "POPE."

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Specify POPE® PRECISION SPINDLES

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Established 1906

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CIRCLE INFORM-A-GRAM KEY NO. 185

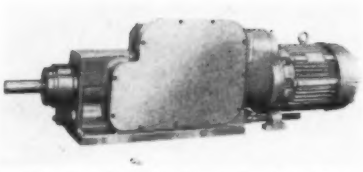

Fig. 1. Camside view of unit. Adjusting screw shown.

quill, which moves in a straight line in a hardened track. Cam leads can be faithfully reproduced in spindle carrier movement.

Clutching and declutching have been greatly simplified by use of an air solenoid operated feed clutch, which gives instantaneous response in starting and stopping the unit cycle. The air clutch can be set to disengage at any desired feeding pressure so that the tool is not forced to the breaking point under excessive resistance, yet performs each operation in the minimum practical time. A single tool may be used in the spindle or a multiple head may be attached to the spindle carrier.

Motor drive is thru gearing to the spindle, and consists of an end mounted motor, ¾ hp to 5 hp. Feed to camshaft is thru gearing mounted on side of case. Mounting of the unit on a machine base has been simplified by eliminating adapter base. A keyway in base of unit is in alignment with spindle and is equipped with side hold down which permits lengthwise movement of the unit with screw adjustment.

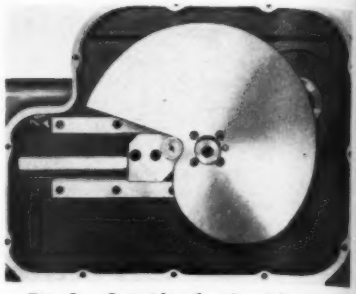

Fig. 2. Camside of unit with cover removed showing plate type hardened tool steel cam, and cam follower moving in straight track.

DISCOVER THE *"difference"*

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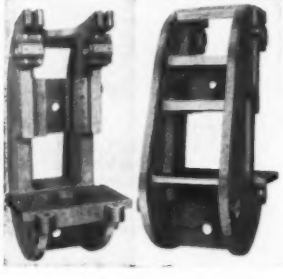
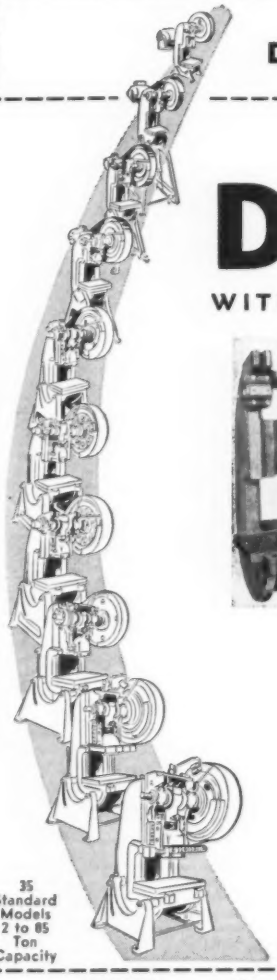
DIE LIFE

WITH PRESS-RITE POWER PRESSES



Rugged reinforced high tensile semi-steel frame with full V adjustable gibs keeps dies correctly aligned assuring accuracy and longer die life. Built-in steel tie rods on all capacities 45 ton and larger.



35 Standard Models 2 to 85 Ton Capacity

Why risk the life of your expensive dies? When you put your dies in a PRESS-RITE Punch Press, you will have complete confidence that you will get more pieces per die, greater accuracy and less die maintenance. Discover the differences in PRESS-RITE design. Let us show you how to get longer runs before grinding dies. Ask your PRESS-RITE distributor or write:

PRESS-RITE DIVISION
SALES SERVICE MACHINE TOOL CO.
2351 University Avenue Minneapolis W14, Minnesota

used by more . . . for more production.

NEW FREE CATALOG

Write for New Press-Rite catalog No. 855 with illustrations, specifications and "Money Making" facts of all models, 2 to 85 ton capacity.

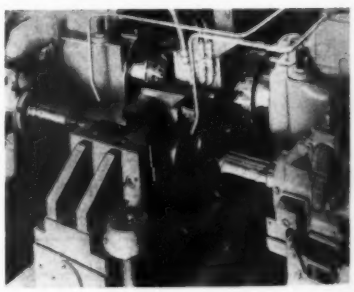
PRESS-RITE

OPEN BACK • INCLINABLE *Power Presses*

CIRCLE INFORM-A-GRAM KEY NO. 186

MORE COMPACT MILLING AND CENTERING MACHINE

A smaller, more compact transfer machine to double-end mill and center drill has been designed that employs the in-line transfer principle. Opposed milling heads and drill heads are way-mounted on either side of a fixture table. The operator loads the fixture at the front. The fixture traverses to the milling heads at the rear of the bed. Milling heads advance from each side, mill, and return. The table then moves forward to the center drilling station, where two drill heads advance, drill, and return. The operator unloads the machined part and reloads the fixture with a new part.



The fixture is hydraulically actuated for clamping. The cycle is completely automatic after loading of the part through the unclamping of the finished piece. Designed to meet lower production requirements, this new model completes a line of milling and centering machines designed and built by The Motch & Merryweather Machinery Company, Machinery Manufacturing Div., 888 East 70th St., Cleveland 3.

New WESSON design cuts cutter costs

"No Grind" Cutter Writes Milling History

Judging from a nationwide survey of metalworking, industry is eagerly looking for a new type of milling cutter, embodying the features to be found in Wesson's newest "no grind" series. Among these features are:

1. **No Cutter Grinding**—Use of low cost throw-away inserts eliminates blade or cutter grinding.
2. **Lower Blade Cost**—Ability to use throw-away inserts with 'commercial ground' thickness tolerances. Precision grinding of faces not necessary.
3. **Quicker Blade Index and Change**—Locking mechanism has only 2 parts—a wedge which forms the chip gullet and a screw which locks and unlocks blade with a half turn.
4. **Automatic Accurate Blade Locating**—Just drop the blade in a clean slot. It locates itself.
5. **Less Down-Time for Tool Changes**—Automatic blade locating when indexing and quick lock-unlock features reduces tool change time to the minimum.

(continued on page 2)

THROW-AWAYS... HOW FAST ARE THEY COMING?

Throw-away tooling is bidding fair to take over a lion's share of metal cutting—both single and multiple point.

Would you like a copy of the first detailed report on the Wesson-sponsored nationwide study on the future of 'throw-aways'? Drop a line on your company letterhead to "Market Research Director", Wesson Company, 1220 Woodward Heights Boulevard, Ferndale 20, Michigan, and he'll be glad to see that you get a copy.

COST CUTTING IDEAS FROM OTHER SHOPS

Have you tried these?

(Continued from a previous issue of Carbide Tool News)

Interchangeability Charts—Something that tells you quickly on what operations you can use identical or similar size tools. Helps to re-assign tools to other jobs on other parts, cuts inventories, insures maximum tool use. One large company is saving $15,000 to $20,000 per month with such charts.

• • •

Progressive Costs—One company reports big reduction in scrap and much better cost-consciousness of workers by telling them how much is invested in a part by the time it reaches them. The part is mounted on a board at each key operation. Alongside is lettered the cost of that part *up to that point.*

• • •

Fault Finding Committees—Putting criticism to work can pay off. Committees can be composed of process, methods and tool engineers who have to meet every so often and come up with criticisms and suggestions of things that probably could be done better some other way. They don't have to agree on what is the best way. The idea is to agree that what you are doing is not the best. Frequently come up with real cost cutting ideas.

• • •

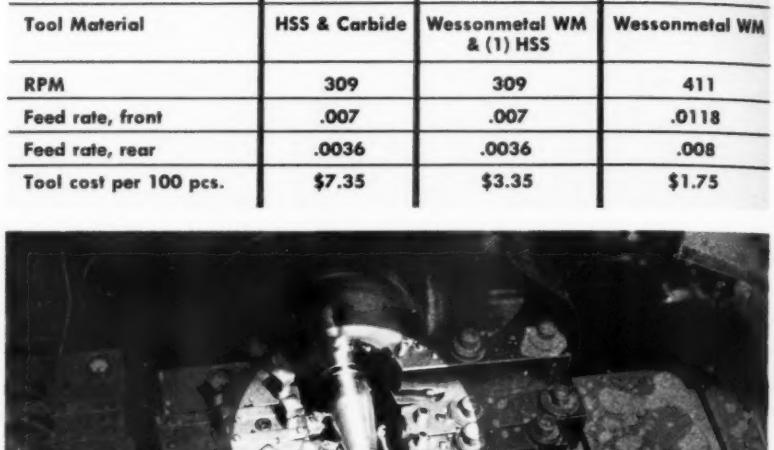
Program Tooling—When tooling up on any operation for the first time, don't just buy tools; buy the brains of a tool company service engineer with the tools. Sure it costs a little bit more for that first set of tools—but it pays for itself on the job over and over again. Wesson engineers prove that every day.

tools Wesson carbide Wessonmetal

WESSON COMPANY DEPT. AD
1220 Woodward Heights Blvd., Detroit 20, Mich.
IN CANADA:
WESSON CUTTING TOOLS, LTD.
93 JUDGE ROAD, TORONTO 18, ONTARIO

Cost Cut Twice on Same Job by Wesson In-Plant Engineering

	Original	Step No. 1	Step No. 2
Tool Style	Milled & Brazed	Multicut & Inserts	Multicut & Inserts
Tool Material	HSS & Carbide	Wessonmetal WM & (1) HSS	Wessonmetal WM
RPM	309	309	411
Feed rate, front	.007	.007	.0118
Feed rate, rear	.0036	.0036	.008
Tool cost per 100 pcs.	$7.35	$3.35	$1.75



The manner in which Wesson's in-plant engineering can help reduce tool cost not just once but over and over is illustrated in the table. The job was the turning of forged steering knuckles at a truck plant.

Originally tooling was a combination of high speed and milled-and-brazed single point carbide tools. There was fairly high tool breakage. First switch was to slug-type solid Wessonmetal inserts in Multicut holders with no basic changes.

Overall tool cost however had been more than cut in half. Every tool on the job with one exception showed better life. That one, used for cutting a thread relief previously had had the best life but now, while producing more pieces per grind than formerly, actually was the worst of the lot.

Tool material change didn't help, so the second step was to change the part design to eliminate this tool. A grade change did help however on another tool in the setup used for chamfering the end of the knuckle.

With tool grades set, adjustments in feeds and speeds resulted in further improvement in overall tool life.

Are you using Wesson's in-plant engineering method of cost reduction? Other metal working plants are. They have learned that Wesson's cost-cutting service doesn't stop with the tool order. That's when it really gets going.

"No Grind" Cutter Writes Milling History—*(continued from page 1)*

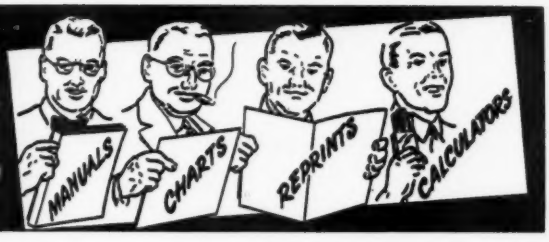
6. Smooth Chip Flow—Shaping of chip gullet gets chips out of the way quickly and smoothly—makes for free cutting.

7. Minimum Body Wear—Specially hardened and quick replaceable chip gullets insure long-life cutter body with the very minimum of upkeep.

8. Rigidity—The cutters are tops in supporting the carbide blades. Almost the entire back face is supported by husky steel while the wedge bears on half the entire front face.

Here is what truly appears to be tomorrow's general purpose milling cutter. With all cutter grinding eliminated—with eight indexes per blade before you discard it—you can even cut your cutter body inventory.

SHOP AIDS



Beryllium Copper Wrought Alloys with unique properties are the subject of a brochure issued by The Beryllium Corp., Reading, Pa. Discussed are the four basic alloys available and their advantages. These alloys are available in strip, rod, bar and wire forms. The engineering data in the brochure details physical and mechanical properties, corrosion resistance and structure. The processing techniques discussed include pressworking, machining, joining, heat treating, surface finishing and hot working. The final section is devoted to illustrating and describing products of beryllium copper. **Circle Inform-A-Gram No. C1.**

Pack Carburizing Steel Parts in solid compounds is used to produce superior physical properties on steel surfaces. This heat treating process is detailed in a technical bulletin. The discussion includes equipment, procedures, replenishment, case depths and trouble shooting. Also given is an explanation of a chart showing the penetration rates for the carburization of steel. Park Chemical Co., 8074 Military, Detroit 4, will provide copies of Technical Bulletin B-1 with details, or — **Circle Inform-A-Gram No. C2.**

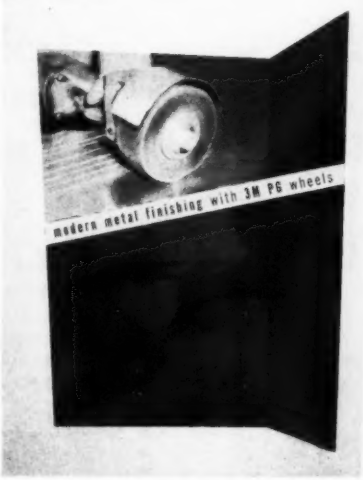
An Industry Standards Booklet for Stud Welding has been announced by KSM Products, Inc., Stud Welding Div'n, Merchantville 8, N. J. It contains a complete index and reference to equipment and accessories used in stud welding applications, covering arc welding studs, pins and tapped pads. Detailed are mechanical properties, thread sizes and plating and annealing information. **Circle Inform-A-Gram No. C3.**

"How to Perform Dye Penetrant Inspections" is a manual of rules for performing inspections by the dye penetrant process. Discussed is every aspect of penetrant flaw location — pre-cleaning, applying penetrant, removing excess penetrant, applying developer and interpreting results. The illustrated folder also contains a "dwell time" chart which details recommended penetrating times for various types of materials and types of suspected defects at various temperatures. Copies of this booklet are supplied by Turco Products, Inc., 6135 S. Central Ave., Los Angeles 1, or — **Circle No. C4.**

The Theory, Principles and Practice of Optical Tooling, a new method of measuring, positioning and aligning, are explained in a 20-page illustrated booklet. In addition, the complete line of Brunson optical tooling instruments and accessories is shown and described. Obtain copies of the booklet from Charles Bruning Co., Inc., 4700 Montrose Ave., Chicago 41, or — **Circle No. C5.**

"The Hot Spray Process" discusses the advantages, causes and effects. The section telling what action takes place in hot spray is supplemented with a graph and drawings. The publication points out how hot spray can bring specific benefits. Also noted are the types of paint heaters on the market. For copies of the publication, write to Bede Products Corp., Jackson St., Amherst, O., or — **Circle Inform-A-Gram No. C6.**

Polishing and Grinding Wheel Applications are described in case history form in an illustrated booklet. Covered are actual applications of "PG" wheels in appliance, aircraft, machinery and other metalworking industries. These wheels are intended to replace setup wheels, sisal



and rag buffs, and greaseless compound and rubber bonded polishing wheels. Copies of the booklet, "Modern Metal Finishing with 3M PG Wheels," are made available by Minnesota Mining and Mfg. Co., Dept. F6-308, 900 Fauquier St., St. Paul 6, Minn., or — **Inform-A-Gram No. C7.**

The Fundamentals of Spring Design are presented in quick, easy-to-grasp form to guide the product designer through the initial stages of a spring design problem in an eight-page brochure. Included are the basic stress and deflection formulas, the commonly used spring materials, typical applications and certain limitations for each of the various types of springs. In addition, the brochure contains a tabulation of the tensile, torsional, and other physical properties of the commonly used spring materials, and the chief uses of each. Request copies of the brochure with 15 charts and graphs, "Spring Design and Selection—in Brief," from Associated Spring Corp., Bristol, Conn., or — **Inform-A-Gram No. C8.**

Blast Cleaning Abrasives — their characteristics, application and selection — are detailed in a 12-page illustrated manual. Discussed are methods for improving cleaning quality and cutting production costs in foundry, descaling, mold and die, shop maintenance and finishing operations. The manual describes the importance of selecting the proper type and size of abrasive, covers abrasive properties and outlines the importance of selecting the correct abrasive for new blast cleaning equipment. Illustrations show typical installations of blast cleaning equipment and a series of photomicrographs demonstrate the difference between shop and grit blasted surfaces. Copies of Bulletin 333 can be obtained from Pangborn Corp., Hagerstown, Md., or — **Circle No. C9.**

Determine the Weight of Springs made from given sizes of round wire or flat stock with a calculator offered by National-Standard Co., Niles, Mich. The calculator is of the circular slide rule type, with one side for round wire and the other for strip. Scales are designed for steel and conversion factors are given for aluminum, brass, copper, Monel, titanium, phosphor bronze and stainless steel. Length is given on a scale ranging from ½" to 50". Weight of strip ranging from 1/16" to 25" in width, 0.001" to 0.300" in thickness, and ½" to 100" long can be calculated on this device. **Circle No. C10.**

Keep Informed • CATALOGS BULLETINS • SPECIFICATIONS

PUBLICATION

For Ease and Convenience Use TOOLING and PRODUCTION Inform-A-Gram Cards

The Fundamentals and Features of General Purpose Static Control Elements are found in an eight-page bulletin. Static control is defined, the advantages listed and the components of the system described. Also explained is how the system operates without moving parts. The bulletin covers the logic function concept, logic functions and conventions control, basic principles and circuit characteristics. General Electric Co., Schenectady 5, N. Y., will supply Bulletin GEA-6578, or —
Circle Inform-A-Gram No. B1.

A Portable Lead Testing Comparator is featured in a bulletin containing descriptive information and giving the range and accessories available for checking lead screws. The comparator accurately checks thread error by inspecting from one flank angle or centralization between both flank angles of the thread. Measuring capacity is from ⅞" to 2½" thread dia in any pitch. Jerpbak-Bayless Co., Solon Rd., Solon, O., or
Circle Inform-A-Gram No. B2.

"Mill Products Data" gives basic information about the physical characteristics and composition of Plume & Atwood alloys. Presented is information on tempers, sizes, weights and decimal equivalents to aid in ordering. Covered in the booklet are nickel silver, phosphor bronze, leaded brass and brass alloys. For complete details, request copies of the booklet from The Plume & Atwood Mfg. Co., Thomaston, Conn., or
Circle Inform-A-Gram No. B3.

Vibration and Noise Absorbing Machinery Mounts utilizing Elasto-Rib are described in an illustrated data sheet. Information is given on the properties of Elasto-Rib and the new Universal Dampers. Construction and installation diagrams of these dampers, and dimension and loading capacity tables are included. Korfund Co., Inc., 48-39E - 32nd Pl., Long Island City, N. Y., will provide copies of Bulletin K2D, or —
Circle Inform-A-Gram No. B4.

For Cutting Non-Ferrous Metals and Alloys in a wide range of shapes and sizes, use Forrest carbide-tipped metalworking blades. These saw blades and others are detailed in a new catalog illustrated with drawings and photos. Presented is detailed constructional information plus a complete description of "O.D. grinds" and their applications. Forrest Mfg. Co., Inc., P. O. Box 189, Rutherford, N. J., or —
Circle Inform-A-Gram No. B5.

Precision Solid Carbide Tools are detailed in a new revised catalog released by The Atrax Co., Newington, Conn. Among the new tools found in the 100-page catalog are miniature hole grinding burs and solid carbide routers 1544 Series. Included are sections on burs, boring bits, boring tools, countersinks, center laps, cutters, drills, grinding tools and reference tables.
Circle Inform-A-Gram No. B6.

Clean Metals contaminated with greases, oils, tars and waxes with Chlorothene cold degreasing solvent. Its advantages include low toxicity, high solvent power and stability. Chlorothene is used for industrial cold-cleaning, dip-cleaning and bucket-cleaning applications. The Dow Chemical Co., Midland, Mich., will provide a pamphlet with details and specifications, or —
Circle Inform-A-Gram No. B7.

Users tell you . . .

How Norton wheels cut O.D. grinding costs and improve quality

Here's the "Touch of Gold" to give your cylindrical and centerless grinding great advantages

Cooler cutting action . . . faster stock removal . . . better finish . . . more pieces per wheel and dressing . . . easier dressing, with less wear on diamond or crushing roll.

Those are typical benefits reported by Norton G Bond and BE Bond wheel users all over the country — concerning every type of O.D. grinding.

It's because both G Bond and BE Bond wheels are so well adapted to cylindrical and centerless grinding. They hold each abrasive grain for maximum cutting action — and outperform all other wheels in many grinding operations, precision or semi-precision. The new Norton "44" ALUNDUM abrasive is proving to be the most outstanding non-premium-priced abrasive for many O.D. grinding jobs.

Note how these wheels can add the "Touch of Gold" that will boost your own product quality and profits. And remember: only Norton offers you such long experience in grinding wheels and grinding machines to help you produce more at lower cost.

PREVIEWS

Circle postage-free Inform-A-Gram Key Number for your request

TOOLING and PRODUCTION'S Inform-A-Gram Section is a CARDload of Information

Several Typical Applications of the Inductosyn for micro positioning in automatic machine tool control are covered in Bulletin 819 released by Farrand Controls, Inc., 4401 Bronx Blvd., New York 70. Detailed are both the linear and rotary types of micro positioning systems. For your copy of the illustrated bulletin including features and electronic characteristics, contact the company, or—
Circle Inform-A-Gram No. B8.

A Pinion Gear Blank Production Line is provided as a typical example of one Jones & Lamson approach to automation. J & L control systems are tailor-made for each individual application. A bulletin presents a schematic view of the production line and gives details on the J & L control systems. Request copies of the bulletin from Jones & Lamson Machine Co., Springfield, Vt., or —
Circle Inform-A-Gram No. B9.

Typical Performance Reports on "44" ALUNDUM* Abrasive

CYLINDRICAL GRINDING

A Wisconsin plant, grinding 2" to 4" diameter steel shafts, 12" length, reports 44 ALUNDUM wheels (44A54-KVBE) cut faster and cooler with no sacrifice of wheel life, compared with best previously used wheels.

A Michigan plant, grinding miscellaneous high speed steel bolt heading dies, finds 44 ALUNDUM wheels best. Reasons are more pieces per dressing, cooler cutting action and 30% longer wheel life than formerly used wheels.

A New Jersey plant found a 44 ALUNDUM wheel (44A36-MVBE), plunge grinding different steel parts, gave many more pieces per dressing and averaged 15% longer life than wheels they used before.

CENTERLESS GRINDING

A Michigan plant, of the smaller jobbing types, grinding all kinds of materials. They prefer 44 ALUNDUM wheels (44A801-NVBE) for versatility, less dressing and faster cutting — including 10-hour completion of a job which used to take 14 hours.

An Ohio plant removes .008" on the rough grind and .003" on the semi-finish grinding of No. 1010 steel crankshaft pins. While standard wheels gave an average of 600 pieces per dressing, they report a 44 ALUNDUM wheel produced 1,000 pieces. All stock was removed in one pass, compared with two passes formerly required.

Another Michigan plant, of large size, tested a 44 ALUNDUM wheel in grinding hardened steel tappets. They report more pieces per dressing, faster cut and less burn than ever obtained before.

Ask Your Norton Distributor for further proof of how Norton O.D. wheels can bring you best possible results. He'll gladly arrange a test in your plant. Distributors in all industrial areas listed under "Grinding Wheels" in the yellow pages of your telephone book. Behr-Manning Division, Troy, New York. *Export:* Norton Behr-Manning Overseas, Inc. **For information write Norton Company, Worcester 6, Massachusetts.**

W-1773

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CIRCLE INFORM-A-GRAM KEY NO. 191

The Complete Line of Waterbury Farrel Rolling Mills and mill auxiliary equipment is covered in a 36-page catalog. Over 25 different types of machinery are detailed. Reference tables include strip coil weight and length calculating graphs and tandem rod mill rolling schedules. The Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., will make available copies of Catalog R, or —
Circle Inform-A-Gram No. B10.

The Complete Inducto Line of induction melting furnaces and related equipment is found in Bulletin 70 now available from Inductotherm Corp., 412 Illinois Ave., Delanco, N. J. Included are installation photos and product information on both the motor-generator induction melting furnaces and Inducto metal melters. Performance tables giving melting times of various quantities of molten metal are also found in the bulletin.
Circle Inform-A-Gram No. B11.

Gear and Pinion Combinations which can be furnished from stock die elements at no tool charge are listed in a bulletin from Gries Reproducer Corp., 400 Beechwood Ave., New Rochelle, N. Y. They are die cast in one piece on specially designed automatic machines. Holes, shafts, spacers, shoulders, etc., are made to specifications. More than 40 individual elements are found in the catalog sheet.
Circle Inform-A-Gram No. B12.

Various Applications of the Flexangle universal slotted angle system are described in a bulletin available from Flexangle Corp., 278 Park Rd., W. Hartford 7, Conn. Among its uses are for stock racks, pallet racks, maintenance ladders, conveyor frames, machine guards and pilot production setups. The structures can be built without drilling, welding or painting. Also described are the reusability of the components.
Circle Inform-A-Gram No. B13.

A Catalog of Template Drill Bushings is being offered by Penn Engineering & Mfg. Co., Doylestown, Pa. These bushings are one-piece units of heat-treated steel which require only a single hole for mounting. They are self aligning and need no indexing. The drill bushings are reported to make template assembly a faster, simpler process. Four types are available for all drill sizes from No. 55 to ½". **Circle Inform-A-Gram No. B14.**

Electrical Remote Positioning Controls for both pushbutton and automatic operation are featured in an eight-page bulletin. Included is a new shaft mounted control gearmotor for valves and variable speed drives to provide remote or automatic flow, speed, proportion and tension control. Each type of control is pictured and described and the dimensions given. For copies of Bulletin J-100, contact The Jordan Co., Inc., 3235 W. Hampton Ave., Milwaukee 9, or —
Circle Inform-A-Gram No. B15.

Make Neater Drawings, faster and easier, using the Mobile parallel ruling straightedge. A system of ball bearing pulleys and cable provides accurate, successive parallel alignments. The Mobile parallel straightedge can be furnished in any standard length and is adaptable to any style or size drawing board or drafting table. For a copy of a folder with details, contact Charles Bruning Co., Inc., 4700 Montrose Ave., Chicago 41, or —
Circle Inform-A-Gram No. B16.

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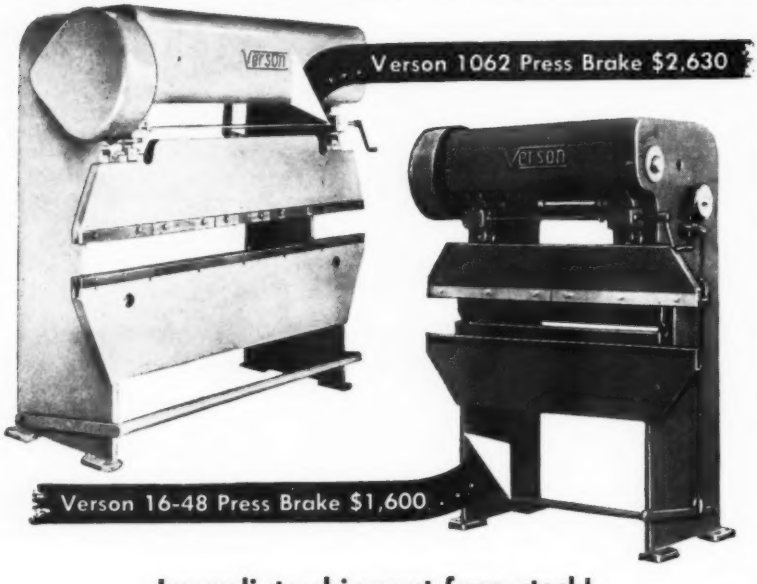
WHERE YOU WANT IT DELIVERED



Immediate shipment from stock!

Standard Dies Also Available
Standard 90° "V" dies for these press brakes are also available from stock. 78" long set for the 1062 is priced at $136.00. 48" long set for use in the 1062 or 16-48 is priced at $102.00. (Prices are for dies to handle 16 ga.).

Verson 1062 and 16-48 Press Brakes are standard production items. You can have one from stock right now! No involved proposals, no long waits.

Standard Verson Model 1062, 16 ga. by 78" capacity, priced at $2,630.00*; Model 16-48, 16 ga. by 48" capacity, is $1,600.00*. Built to big brake standards, these power brakes are compact and low in cost, rugged and efficient in performance.

Call for a Verson Standard Press Brake today. Both are available from stock.

*Prices, F.O.B. Chicago, less dies; subject to change without notice.

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION
Verson
VERSON ALLSTEEL PRESS CO.
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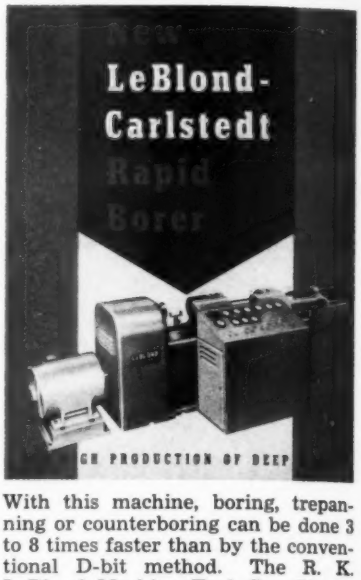
TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES

CIRCLE INFORM-A-GRAM KEY NO. 192

For High Production of Deep Holes, use the LeBlond Carlstedt Rapid Borer. It is suited to work that is symmetrical for balance in rotation — round, square, octagonal, tapered or stepped. A wide variety of hole diameters and depths as well as work sizes can be accommodated.



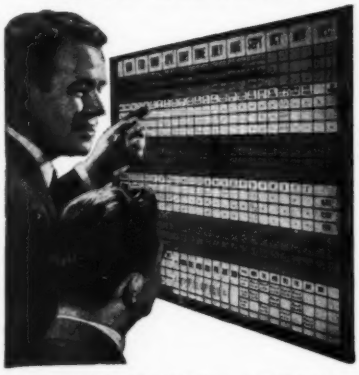
With this machine, boring, trepanning or counterboring can be done 3 to 8 times faster than by the conventional D-bit method. The R. K. LeBlond Machine Tool Co., Cincinnati 8, will provide copies of Bulletin LC-501 with further details, or —
Circle Inform-A-Gram No. B17.

Controls for Liquids and Gases are contained in revised General Catalog 005 prepared by Simplex Valve & Meter Co., Lancaster, Pa. Illustrated are many types of controllers, gages, manometers, recorders, meters, valves, Venturi tubes and other equipment for the measurement and control of liquids and gases. Each is described and the specifications given. Direct requests for the catalog to the company, or —
Circle Inform-A-Gram No. B18.

Faster Low-Cost Wire Terminations are possible with the Fingrip strip terminal featuring greater gripping power. It snaps directly into a mating tab eliminating screw-type installations and separate tooling. The Fingrip gives four individual gripping actions. For details, dimensional data and installation information, obtain the bulletin, "Fingers of Strength," from Burndy, Omaton Div'n, Norwalk, Conn., or —
Circle Inform-A-Gram No. B19.

A Miniature Slip Clutch is one of several new items which has been included in the new E-88 Dynaco Precision Stock Gear Catalog issued by Dynamic Gear Co., Inc., 20 Merrick Rd., Amityville, N. Y. For complete information, request copies of the catalog from the company, or —
Circle Inform-A-Gram No. B20.

How To Get Things Done Better And Faster



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CIRCLE INFORM-A-GRAM KEY NO. 1931

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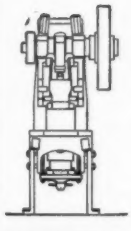

We invite your inquiries, as we have a complete engineering staff to analyze any of your requirements.

DAYTON ROGERS *Manufacturing Company*

MINNEAPOLIS 7B, MINNESOTA

CIRCLE INFORM-A-GRAM KEY NO. 1932

PREPARES COIL STOCK FOR PRESS

New Low Cost

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Handles stock up to 3" wide, 1/8" (app.) thick

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CIRCLE INFORM-A-GRAM KEY NO. 1933

Anything... in THROW-AWAY *INSERTS*,

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Viking

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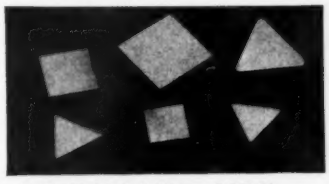

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Cutting Tool Engineers and Manufacturers

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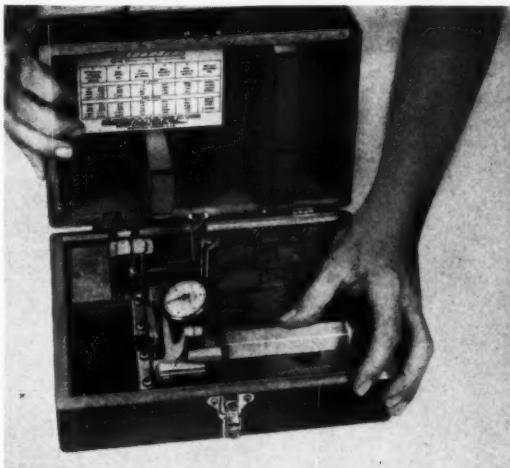
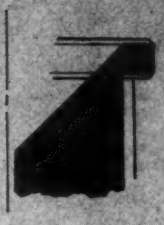


Full line contact for long segment wear.



Straight line motion guarantees accurate measurement over full range.

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This Kit Checks Grooves for

O-Rings — .421 to 4.870 Diameter.

Snap Rings — .267 to 5.266 Diameter.

- Line contact assures long segment life
- No bearings or sliding members to wear
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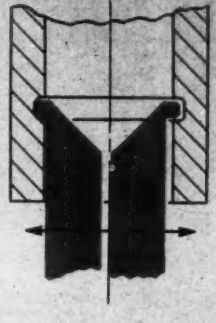

Special segments available for checking non-standard grooves; concentricity of groove to bore, or depth of groove to face.

Groove segments can also be used on the Bryant B-21 Bench Gage.

WRITE FOR FULL INFORMATION ON BRYANT GAGES

Bryant Gage & Spindle Division

P. O. Box 620-F, SPRINGFIELD, VERMONT

Division of Bryant Chucking Grinder Company

CIRCLE INFORM-A-GRAM KEY NO. 1935

A MILE OR A SLICE
of tool steel for you
IS IMPORTANT TO MILNE

Milne's tool steel orders come in three sizes . . . small, medium and large. Across the continent, Milne has 40 saws cutting tool steel to your order, whether it's in pounds or tons.

And wherever you are, a Milne man is near you. There are 38 Milne tool steel specialists strategically placed to help you with tool steel problems and expedite your order.

Big or little, your order gets the maximum in Milne service.

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AMCON Hollow die - Annealed - Spray Painted PINK for identification
1 Pc. 6" OD x 3" ID x 2" Long - 14 lbs.
ORDERED: 10/18/56 10 A.M.
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Wide range of sizes and grades in WATER HARDENING—NON-DEFORMING—SHOCK-RESISTING—HOT WORK AND HIGH SPEED TOOL STEELS

All full length Kolorkoted for permanent identification

Write or call for Milne's Tool Steel Selector.

AM-29

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Established 1867
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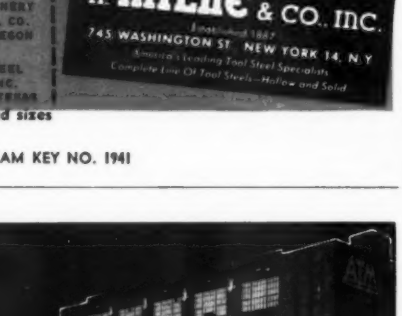
MAKERS OF "REPUBLIC," "CENTURY," "CELFOR" AND "U.S. EAGLE" BRAND TOOLS

3 PLANTS — NEW YORK CHICAGO LOS ANGELES



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CIRCLE INFORM-A-GRAM KEY NO. 1942

WHAT'S YOUR ENGRAVING PROBLEM

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- Need greater speed for engraving light and medium characters . . . use Preis-Panto Model UE or UE-2.
- Does work require heavy duty machines . . . use Preis-Panto Model UE-3.
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There's a Model available to solve all your particular problems economically.

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Write for complete details and prices. For immediate attention write directly to manufacturer below. Ask for nearest representative.

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UNIVERSAL CARBIDE GRINDER

with the Patented RECIPROCATING ACTION

. . . Has a CHIP BREAKER ATTACHMENT and table for small radius grinding as STANDARD equipment.

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HAGER

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Mfrs. of Hager Measuring Microscopes

CIRCLE INFORM-A-GRAM KEY NO. 1944

Magnetic Base Indicator holders

Erick Magna Holder Model 2008 Only $5.45

See your dealer or write for catalogue 755 on the most complete line of magnetic base units & access. mfg'd.

CULLEN MFG. CO., RACINE, WIS

CIRCLE INFORM-A-GRAM KEY NO. 1945

Design and Installation Requirements for Laminated Shims of brass, mild steel, stainless steel and aluminum are found in an eight-page catalog published by The Laminated Shim Co., Inc., Glenbrook, Conn. On

one page are itemized the sizes and prices of more than 100 cup shims of solid brass to fit standard tapered roller bearings of all sizes.
Circle Inform-A-Gram No. B21.

The Advantages of Automatic Battery-Charge Controls for emergency light-protection units are outlined in a folder, Form 5926, published by The Electric Storage Battery Co., Exide Industrial Div'n, Box 8109, Philadelphia 1. Discussed is how manual switching has been eliminated in the latest Exide designs. An operation chart demonstrating the reliability of the automatic charge control device is also presented.
Circle Inform-A-Gram No. B22.

"Dust Control for Industry" takes in a complete range of dust control equipment and accessories. Emphasized is the importance of dust control to industry in relation to reduced maintenance costs, employee morale and commercial utilization of dust by-products. Listed are the primary component parts of an engineered dust control system. Copies of Bulletin 922 can be obtained from Pangborn Corp., Hagerstown, Md., or —
Circle Inform-A-Gram No. B23.

Complete Engineering Data and Specifications are contained in an eight-page condensed version of a 144-page catalog released by National Machine Products Co., Utica, Mich. Included are hexagon nuts, sizes ¼" to 3", and 12 pointer nuts, sizes ¼" to ⅝". Also covered are Huglock and Marsden locknuts, sizes ½" to 1½". Copies of the eight-page brochure are provided by the company, or —
Circle Inform-A-Gram No. B24.

Flexible Couplings are fully described in a new 24-page catalog. The Morflex principle is explained and illustrated. Complete dimensions and specifications are given on standard, double and radial type couplings with additional data on coupling drive shafts. Torsional deflection charts and instructions for use explain the method of coupling selection in controlling the torsional vibration of a system. Morse Chain Co., Ithaca, N. Y., or —
Circle Inform-A-Gram No. B25.

Die Sets and Accessories are featured in Die Set Catalog 11 published by The Producto Machine Co., 990 Housatonic Ave., Bridgeport 1, Conn. The catalog consists of a 56-page technical section and a 20-page net price book that can be read separately. Introduced are rectangular progressive rear pin die sets, die sets for Multi-Slide, four slide and die machines, removable bronze bushings and a packaged die spring assortment.
Circle Inform-A-Gram No. B26.

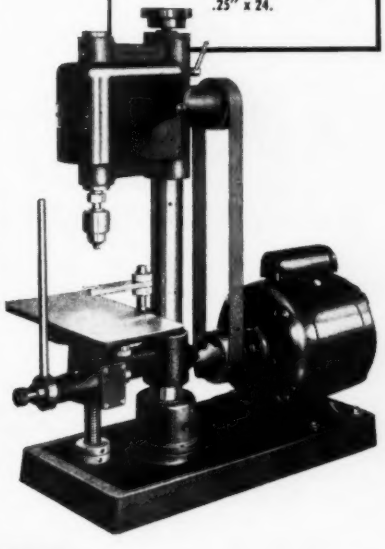
Now *Precision* TAPPING OF THIN AND BRITTLE MATERIALS

Recent design change provides a simple homing device as a standard component of the

HAMILTON
SUPER SENSITIVE, SMALL-HOLE
PRECISION
TAPPING MACHINE

and makes routine of such problem work as the tapping of precision holes in thin metal sheets or in brittle plastics. Even improves performance in the tapping of blind holes!

Hamilton Super Sensitive, Small-Hole, Precision Tapping Machine.
Capacity — .034" x 120 to .25" x 24.



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BULLETIN No. 2463

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2463

CIRCLE INFORM-A-GRAM KEY NO. 195

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Special Sizes are given extra attention to be sure you get FAST service.

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CIRCLE INFORM-A-GRAM KEY NO. 1962

Over 85% of the torque wrenches used in industry are

STURTEVANT TORQUE WRENCHES

Read by Sight, Sound or Feel.

- Permanently Accurate
- Practically Indestructible
- Faster—Easier to use
- Automatic Release
- All Capacities

in inch grams . . . inch ounces . . . inch pounds . . . foot pounds (All sizes from 0-6000 ft. lbs.)

Every manufacturer, design and production man should have this valuable data. Sent upon request.

PA STURTEVANT CO.

CIRCLE INFORM-A-GRAM KEY NO. 1963

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Lacey Die-Set Machine

Here's a truly "one man" press. It operates with one hand. Handy for tool and press rooms, it permits the die-maker to complete a die-set at his bench . . . saves toolroom and handling costs. Ask today for full details.

Sole Distributors

MOORE SPECIAL TOOL CO., INC.
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Low Cost Automatic

HORIZONTAL STOCK REEL

Self-powered

24" dia. $85.00
30" $90.00
36" $95.00

Write for details

JACO DEVICES, INC.
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CIRCLE INFORM-A-GRAM KEY NO. 1965

"Reduce Production Costs with Esco Shellcast" covers casting facilities and products. Among the advantages described in the brochure are good reproduction detail, reduction of weight and conservation of

material, castings of close dimensional tolerance and reduction of machining costs. Copies of Esco Shellcast Brochure 205 are available from Electric Steel Foundry Co., 2141 N.W. 25th Ave., Portland, Ore., or — **Circle Inform-A-Gram No. B27.**

Speed Production and Cut Costs with the Trambeam for overhead handling. A bulletin, in addition to illustrating and describing overhead material handling equipment, shows typical installations. Covered are suspension, track, carriers, motor drives, electrification, cranes, switches and monorail systems. Copies of Bulletin M-20R2 with complete information, are made available by Whiting Corp., Harvey, Ill., or — **Circle Inform-A-Gram No. B28.**

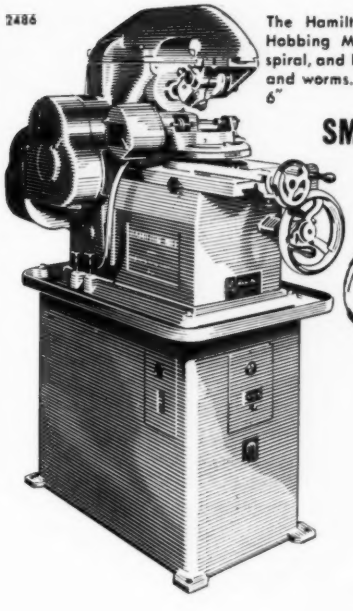
The Advantages of Drawn Tube Wire are outlined in a booklet published by Haynes Stellite Co., Div'n of Union Carbide and Carbon Corp., Kokomo, Ind. The drawn tube wire assures smooth feeding to automatic hard-facing operations without the aid of special adaptors. Any standard welding machine can be used to apply this product. The booklet lists typical applications and details application procedures.
Circle Inform-A-Gram No. B29.

Designed to Make High Speed Milling More Profitable are RC milling cutters with Throway carbide inserts. Cutters are available using square or triangular blades. For specifications, prices and selection data on RC milling cutters, request copies of Catalog 11156 from Newcomer Products, Inc., Latrobe, Pa., or — **Circle Inform-A-Gram No. B30.**

Suited to Manual and Automatic Progressive Assembly, inspection and light machining operations is the Conveymatic platen conveyor. It combines accurate movement, locating, indexing, timing and rate of travel of small parts for all types of these operations. A diagram shows a typical machine tool arrangement on the Conveymatic. For details, see a bulletin published by Visi-Trol Engineering Co., 9345 Hubbell, Detroit 28, or —
Circle Inform-A-Gram No. B31.

Protect Pressure Gages and other pressure devices operating at extremes of pressure with an improved high pressure gage snubber. Protection of instruments against line surges and pulsations on systems having total pressure increments of as high as 60,000 psi is made possible by discs of porous stainless steel. Further information is found in a circular, Form 855, which can be obtained from Chemiquip Co., 460 W. Broadway, New York 12, or —
Circle Inform-A-Gram No. B32.

2486



The Hamilton No. 1-B Precision, Small-Gear Hobbing Machine. Generates precision spur, spiral, and bevel gears, face gears, worm gears, and worms. Maximum diameter of work piece, 6"

SMALL PRECISION

Gears without tears

HERE'S WHY

The Hamilton Precision, Small-Gear Hobbing Machine, the hobber with a "reserve of accuracy," regularly holds work spindle and hob spindle run out to less than .0002", work spindle and tailstock spindle alignment to less than .0002". ***And this standard of workmanship is maintained throughout the machine.***

FURTHER

Speed, feed, and indexing each can be selected individually and independently. *THINK* OF THE TIME TO BE SAVED BECAUSE OF THIS *ONE* FEATURE!! And scores of additional features are described in our Gear Hobber Bulletin No. 2486 which we will be glad to furnish to you FREE.

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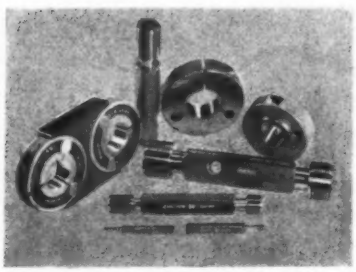
ADDRESS

THE HAMILTON TOOL COMPANY
832 South Ninth Street
HAMILTON, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 197

We can't live without customers

Our gage making skills would be wasted if there were no customers to profit from them. So when an order is processed, all these skills are directed at supplying the customer with exactly what he needs and when he needs it. We diligently try to grind all gages to the high limit of the tolerance, then fully lap them. Such gages, both thread and cylindrical, give extra wear life. This is not the only extra that customers receive. Their gaging program is never bogged down from drunken threaded gages; the metal hardness is always as specified. Since 1951 every customer has been regarded as Head Man in our organization. That, perhaps, is the big reason our customers have steadily grown in number. If you are not one of our head men, perhaps you would like to be. It would please us.



LINCOLN GAGE COMPANY
23902 Harper Ave.,
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CIRCLE INFORM-A-GRAM KEY NO. 1981

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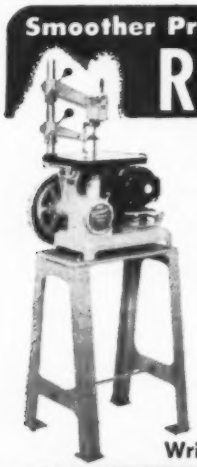
RICE-MILWAUKEE

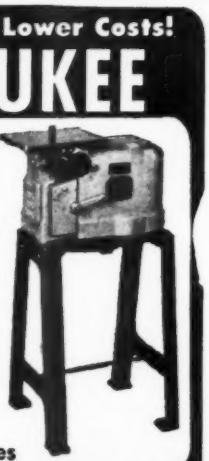


DIE FILERS . . . for straight-line sharp corner filing, sawing and lapping. This low cost precision-built unit performs all die making operations at savings up to 40%. Furnished complete with motor and two overarms. No extras to buy.

PROFILE GRINDERS

. . . for high speed Precision Grinding of Curved and Irregular Contours.

Standard features include 20,000 or 30,000 R.P.M., or a combination of these spindle speeds, ½ H.P. motor, Collet Chuck, Compound tilting table, built-in wheel dresser.



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RICE PUMP & MACHINE COMPANY
228 PARK AVENUE BELGIUM WISCONSIN

CIRCLE INFORM-A-GRAM KEY NO. 1982

ACCURATE INSPECTION TOOLS

Accuracy of measurement depends on the precision of the measuring tools. Provide your Shop and Inspection Department with dependable and proper inspection tools. MEEHANITE METAL TOOLS, made to close tolerances, are furnished in many types.

Surface Plates — Box Parallels
Slotted Angle Plates
Universal Right Angles
Flat Parallels — Lapping Plates
Toolmaker's Knees — "V" Blocks
Straight Edges (Bridge Type)
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SURFACE PLATES RESCRAPED

ACME TOOL CO.
75 W. Broadway, New York 7, N.Y.

CIRCLE INFORM-A-GRAM KEY NO. 1983

NO BREAKAGE

PRODUCTO
UNIVERSAL
HAND TAPPER

For accurate hole-tapping without tap breakage, this Hand Tapping Machine is a "must" for every tool and die shop and toolroom. You can tap holes at any point in work within area of machine table. Quick-change spindles hold taps. Ready for instant use. Write for Bulletin TE4-102.

The Producto Machine Co.
970 Housatonic Avenue
Bridgeport 1, Connecticut

CIRCLE INFORM-A-GRAM KEY NO. 1984

A Fully Automatic Cycle for every basic turning requirement is an advantage of Model 21 Mona-Matic lathe. This machine and its features are discussed in detail in an illustrated 24-page catalog. There is no

limitation of the amount of stock the machine is capable of removing. Also given are specifications. For complete information, obtain Bulletin 1808 supplied by The Monarch Machine Tool Co., Sidney, O., or —
Circle Inform-A-Gram No. B33.

Industrial Inspection of Deep Recessed Areas such as cylinder walls, tubes, etc. is performed by illuminated Borescopes. A catalog gives general data, illustrates typical applications and lists other applications. In addition, the various models available are illustrated and described. Obtain copies of the 16-page catalog from National Electric Instrument Co., Inc., 92-21 Corona Ave., Elmhurst 73, N. Y., or —
Circle Inform-A-Gram No. B34.

Abrasive Cut-Machining Units are the subject of a booklet from Wallace Supplies Mfg. Co., 1300 Diversey Pkwy, Chicago 14. Explained briefly are the various types of abrasive cut-off saws. The various units are shown with the types of work that they can handle. Covered are abrasive swing, chop and rotating type cut-off units and Speedy-Cut portable band and hack saws.
Circle Inform-A-Gram No. B35.

A Line of Pressure and Chemical Gages is presented in Bulletin DH-23 from American Chain & Cable Co., Inc., Helicoid Gage Div'n, Bridgeport 2, Conn. These units can be used on hydraulic presses, pumps, compressors, etc. To meet specific service requirements, these gages are made in two types of case material, four types of Bourdon tube systems and five different case designs.
Circle Inform-A-Gram No. B36.

Designed for Operations in Cramped Quarters, tight aisles and close corners is the Powrworker industrial truck. A bulletin is divided into sections, each dealing with one of the construction features of the truck. A two-page spread contains an illustration of the Powrworker, pointing out its operational advantages. Also contained in the bulletin are attachments. Clark Equipment Co., Battle Creek, Mich., will provide copies of the bulletin, or —
Circle Inform-A-Gram No. B37.

Thirty-Seven Different Basic Fastening Devices are illustrated in a condensed stock list of Allmetal stainless steel fasteners. Included are screws, bolts, nuts, washers, rivets, pins and "AN" specification fasteners. Charts contain data pertaining to diameters, lengths, threads, head and point styles, and grades of stainless steels. Request copies of the stock list from Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, L. I., N. Y., or —
Circle Inform-A-Gram No. B38.

PORTELVATOR®

The Handy HAMILTON Portable, Elevating Table

A PORTABLE HEIGHT-ADJUSTABLE TABLE
● TRUCK
● WORK BENCH

for
DIE TRANSFER
● MACHINE FEEDING
● ASSEMBLY AT BEST HEIGHT IN BEST LIGHT

LIFTING
● LOWERING
● TRANSPORT
of
SHEETS
PLATES
BARS
TUBES
PIPES
TOOLS
DIES
FIXTURES
●
ALL
COMPACT HEAVY
LOADS

UNOBSTRUCTED PERIMETER
●
WORK FROM ANY SIDE

MORE SERVICE for LESS MONEY than ANY Other Unit of Equipment

43 table surfaces
point support

Recent changes and additions to the line provide greater capacities, new flexibility, *many bonus features*.

Write for NEW, FREE Bulletin P-5604

Address THE HAMILTON TOOL COMPANY,
832 South Ninth Street, Hamilton, Ohio

IT'S A Hamilton Tool
USE IT WITH CONFIDENCE
5604

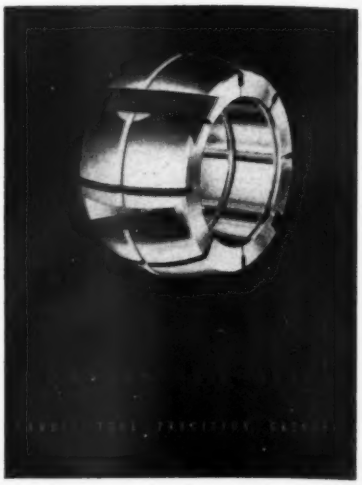
CIRCLE INFORM-A-GRAM KEY NO. 199

The Latest Additions to the "No-Grind" Line of Throw-Away Tooling are covered in Technical Bulletins 896-1 and 2 from Wesson Co., 1220 Woodward Heights Blvd., Ferndale 20, Mich. The tools covered are 30° and 45° chamfering tools which can be also used for a variety of other operations and are suited to gang setups. In addition to photos, engineering drawings and specifications, line drawings illustrating typical applications are shown.
Circle Inform-A-Gram No. B39.

Sprag Clutches for overrunning, indexing and backstopping applications are described and illustrated in Catalog 104-C from Formsprag Co., 23601 Hoover Rd., Van Dyke, Mich. Provided is detailed engineering data and dimensions, installation and maintenance information, and typical mounting arrangements. Also included are suggestions for selecting and ordering standard clutches, as well as a description of the company's special design service.
Circle Inform-A-Gram No. B40.

CIRCLE INFORM-A-GRAM KEY NO. 200

The Construction and Operation of Microsphere wheel spindle bearings are shown in a catalog. These bearings are used on Landis precision cylindrical grinding machines. Included in the catalog is a drawing of



a typical Landis tool wheel spindle assembly showing the Microsphere bearings. Landis Tool Co., Waynesboro, Pa., will make available copies of Bulletin MB-56, or — **Circle B41.**

Impact Extrusion in Aluminum is detailed in a folder released by Cliff Mfg. Co., 30240 Lakeland Blvd., Wickliffe, O. Shown are typical impact extruded parts and a few of the many design possibilities. Also pictured are the company's facilities. For further details, see the bulletin put out by the firm, or — **Circle B42.**

Stainless Steel Bar and Wire is described in an illustrated folder from Armco Steel Corp., P. O. 2856, Middletown, O. Covered are both standard and special grades. Shown in the folder are some typical applications of the bar and wire. Contact the company for a copy of the folder, or — **Inform-A-Gram No. B43.**

Three New Allenair 4-Way Air Valves have been added to the line of ¼", ⅜" and ½" air valves. They are available as single solenoid or for foot or cam operation. These valves and others in the Allenair line are detailed in a catalog with price list made available by The A. K. Allen Co., 57 Meserole Ave., Brooklynn 22, or — **Circle No. B44.**

A Straight Line Transfer Machine is the subject of a folder from Kenhos Corp., 275 Connecticut Ave., Norwalk, Conn. It is ideal for machine assembly, complete sequence machining and complete process machining. Copies of the circular listing the general features and specifications are made available by the company, or — **Circle No. B45.**

UNMATCHED

Repeatability

WITH

Em-re DIAL INDICATORS

THE ONLY

100% SHOCKPROOF DESIGN

There's never been a dial indicator like the "Em-re." It combines a new and greatly simplified design with a fully jeweled gear mechanism that is indestructible. As a result it gives you readings of previously unobtainable accuracy — accuracy that will repeat itself without deviation through millions of measurements. "Em-re" .00005" and .0001" models, for example, provide repeated readings to an accuracy of better than .00002". And the *completely* shockproof "Em-re" system preserves and *actually contributes to* this repeatability over a lifetime of service. Stocked in 26 models, 8 ranges from .002" to 1.000"; graduations in .00005", .0001", .00025", .0005" and .001". *Also available for accurate indicator testing — the "Master" Dial Indicator Checker.*

Write for Catalog **E**

PETZ-EMERY INC.
PLEASANT VALLEY, NEW YORK

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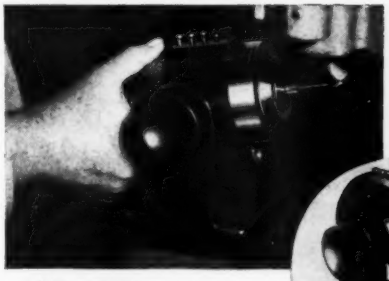
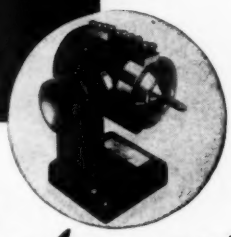
REDUCE TAP COSTS UP TO 75%





with the *Rocket*

TAP SHARPENER

Push button control — no cams needed. 50 series for 2, 3, 4 flutes collet capacity to 1-1/16". 60 series for 4, 5, 6 flutes collet capacity to 2-1/4". Special orders for additional flute capacities.

Use on any tool and cutter grinder or small surface grinder . . . Guarantees precision sharpening through accurate grinding.

a low cost

fixture that sharpens dull taps

- **quickly**
- **economically**
- **accurately**

Write for demonstration and literature

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1820 Seventeenth Ave. Rockford, Ill.

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Buy safe "SHUR-GRIP" drop forged HANDLES

Designed to hold 3 to 6 lb. lead hammer heads more firmly — will not slip — keeps hammer head in shape longer — makes remolding easier, quicker, surer, less expensive.

Write for circular and prices

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68 MASSASOIT AVENUE, EAST PROVIDENCE 14, R. I.

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PRESSURELOK-224

the best diamond wheel ever developed for carbide tool grinding. Guaranteed ultimate cutting life from each diamond particle in every wheel.

UNITED STATES DIAMOND WHEEL CO.
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IMMEDIATE DELIVERY on all wheel sizes. STRAIGHT, DISH, CUP, FLARE and MOUNTED WHEELS; HONES.

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IN 11 SIZES No. 6 to 1" N.C. In all S. A. E. sizes.

You Need an Extra Hand Now to Speed Up Production!

HEIMANN TRANSFER SCREW SETS

Here is the *faster*, more precise way of transferring open and blind screw holes—make savings in "wage-dollars-per hour" of your expensive hands on every job. A die-and-tool maker's tool with many other applications for die makers and machinists. A set of 6 Hardened Screws nested in combination holder and wrench —no other tools needed. Get more work *now*—save money too!

HEIMANN MFG., CO. • URBANA, OHIO

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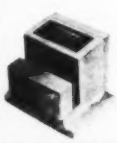
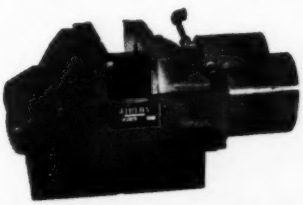
TM REG. U. S. PAT. OFF.

AIR VISES — ALL TYPES GRIPS — 5 TO 200 X AIRLINE PRESSURE



POWER HEADS



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TERMINAL CRIMPERS

SPECIAL PRESSES

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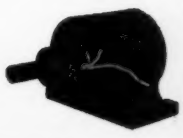

by **production devices incorporated,** Whitehall, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 2016

Now You Can Test
CRATEX
RUBBERIZED ABRASIVES

"cushioned action performance"

In Your Own Plant On BURRING, SMOOTHING and POLISHING operations

To meet the demand for "A Testing Kit" we have just developed the

CRATEX POLISHING KIT

Containing a comprehensive assortment of 24 of the most popular CRATEX Polishing Wheels, Cones, Blocks and ¼" Shank Mandrels—in a variety of "grit textures"—especially engineered for plant craftsmen—including complete Instruction Bulletin—for either manual or machine applications.

For cleaning and polishing molds, dies & castings; removing film, coatings & enamel; blending in and polishing welded seams after rought grinding; polishing bearing surfaces and raceways; removing rust, heat-marks, tarnish, excess solder, fatigue lines, scratches, corrosion and other unacceptable surface defects.

24 Items Complete Kit **$12.50**

Investigate and test CRATEX Rubberized Abrasives—"the world's finest for industrial use"—unduplicated for lowering "unit costs." The "cushioned action performance" gives unparalleled results on production and assembly lines; in tool and machine shops. Send for Illustrated Catalog showing wide range of sizes, application details and prices.

Test Cratex Rubberized Abrasives

Order the CRATEX POLISHING KIT on your regular Purchase Order—send to us and we'll send the "KIT" through our Industrial Distributor in your area.

CRATEX MANUFACTURING CO.
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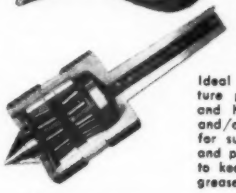
CIRCLE INFORM-A-GRAM KEY NO. 2021

IDEAL GOLD BAND
LIVE CENTERS

GUARANTEED TO MATCH OR EXCEED, "CRITICAL" JOB SPECIFICATIONS

In the GOLD BAND line Ideal has combined the latest production methods with their traditionally fine craftsmanship to bring you an unequalled standard of excellence in live centers. Accurate, (to ± .0001") GOLD BAND Live Centers offer "custom" quality at production prices. Specify GOLD BAND Live Centers and your every need can be accommodated from stock . . . 99 times out of 100. Ideal's GOLD BAND Live Centers offer savings, simplified operations and higher lathe output both in quantity and quality. Contact your distributor today . . . or



PRECISION FITTED BEARINGS

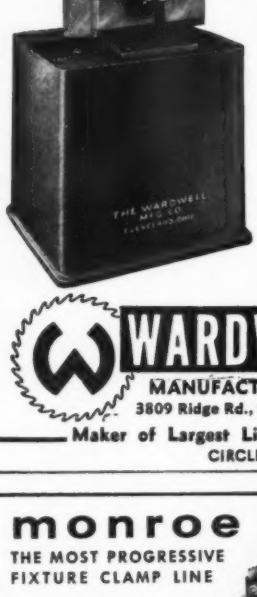
Ideal Live Centers feature precision machined and hardened ball and/or roller bearings for superior accuracy and performance. Sealed to keep dirt out, grease in.

A COMPLETE LINE FOR EVERY NEED . . . SPECIALS, TOO!

Send for
Complete catalog data and specifications.

IDEAL INDUSTRIES, Inc.
1334-B Park Ave., Sycamore, Ill.
DISTRIBUTED BY THE NATION'S LEADING INDUSTRIAL DISTRIBUTORS

CIRCLE INFORM-A-GRAM KEY NO. 2022



AUTOMATIC GRINDER FOR METAL SAWS

Cuts Costs . . . Makes Money For You!

Pays for itself time and time again. Will sharpen as many as 250 Milling Cutters, Slitting and Screw Slitting Saws .015" thick at one time with a variation, plus or minus .001" of exact diameter for entire lot. Automatically indexes the gang of saws, one row of teeth at a time.

WARDWELL MANUFACTURING CO.
3809 Ridge Rd., Cleveland 9, O.

Steady, accurate, durable. Grind either wet or dry. A time and money saver.

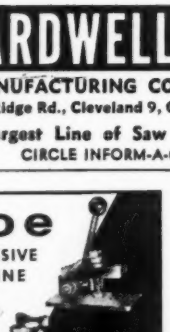
Ask for Bulletin describing 57T

Maker of Largest Line of Saw and Tool Sharpening Machines

CIRCLE INFORM-A-GRAM KEY NO. 2023

monroe
THE MOST PROGRESSIVE FIXTURE CLAMP LINE

Catalog available from
monroe
Engineering Products
1515 Hurd Road
Monroe, Michigan



CIRCLE INFORM-A-GRAM KEY NO. 2024

New Low Cost
AUTOMATIC SCRAP CHOPPER
3" wide **$69.00**
6" wide **$95.00**
12" wide **$195.00**
Write for details

JACO DEVICES, INC.
96 High St., Hingham, Mass.

CIRCLE INFORM-A-GRAM KEY NO. 2025

Rigidrop Piston Lift Gravity Drop Hammer is highlighted in Bulletin 361 from Erie Foundry Co., Erie, Pa. With no board replacement, there is a minimum of downtime. The construction features of the hammer are detailed complete with photos and drawings. Also listed are the specifications. For copies of the bulletin, write to the company, or —
Circle Inform-A-Gram No. B46.

Precision Pressure Regulators are featured in a catalog from Stratos Div'n, Fairchild Engine & Airplane Corp., Bay Shore, L. I., N. Y. Detailed is the Governaire principle of operation. Each of the regulators is shown, described and the specifications given. Also given is performance data on each of the series produced by the company.
Circle Inform-A-Gram No. B47.

Cut Straight or Tapered Internal Key Ways from ⅛" to 1" wide with Model K-6 keyseater. It is recommended for job shops, maintenance departments, toolrooms and production shops. The construction features are pointed out and the specifications listed in an illustrated circular released by Northfield Foundry & Machine Co., Northfield, Minn., or
Circle Inform-A-Gram No. B48.

Collect Dust or Mist with Dustkop dust collectors. They range in size from 10,050 cfm capacity unit which can remove dust from as many as 16 points simultaneously, to the 314 cfm unit for removing dust from small grinding and buffing operations. A bulletin with details showing some typical applications is supplied by Aget Mfg. Co., Adrian, Mich., or —
Circle Inform-A-Gram No. B49.

Woven Wire Conveyor Belts are discussed in "6 Ways to Increase Heat Treating Production." These belts combine movement with processing during continuous heat treating. The pamphlet contains a flow sheet representing two typical lines for heat treating of spring assemblies. Request copies of the pamphlet from The Cambridge Wire Cloth Co., Cambridge, Md., or —
Circle Inform-A-Gram No. B50.

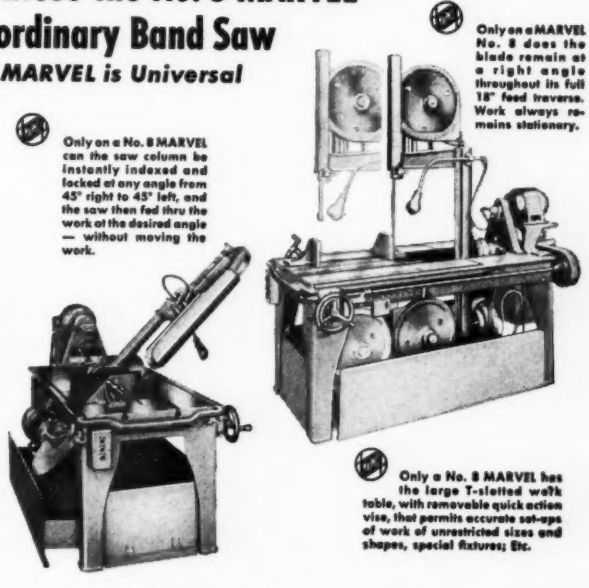
Heavy Duty Precision Switches for Machine Tools and other industrial equipment are highlighted in a folder, Form 84-222, from Micro Switch, Div'n, Mineapolis-Honeywell Regulator Co., Freeport, Ill. Each item is pictured, described and the features listed. Also discussed is the snap-action precision basic switch. The company will supply copies of the folder, or —
Circle Inform-A-Gram No. B51.

Three Models of Surface Allcase Furnaces are described in Bulletin SC-174 supplied by Surface Combustion Corp., Toledo 1, O. These furnaces with an operating range from 1400°F to 1750°F, can be used for gas carburizing, clean hardening, dry cyaniding, and carbon restoration. In addition, they're used for homogeneous carburizing, clean annealing, oil quench and marquenching. A chart presents the range of loads and heating rates for all three models.
Circle Inform-A-Gram No. B52.

Available in Six to Fifteen Ton Capacities are self-supporting jib cranes produced by R. G. LeTourneau, Inc., 2399 S. MacArthur, Longview, Tex. A folder with illustrations and data, covers the company's complete line. Noted is the effectiveness of the cranes in handling such items as castings, ingots, machine tools, pattern molds, power units and other loads within the 30,000-lb class. Get your copy of the folder from the company, or —
Circle Inform-A-Gram No. B53.

Never Confuse the No. 8 MARVEL with an ordinary Band Saw

...only the MARVEL is Universal



Only on a MARVEL No. 8 does the blade remain at a right angle throughout its full 18" feed traverse. Work always remains stationary.

Only on a No. 8 MARVEL can the saw column be instantly indexed and locked at any angle from 45° right to 45° left, and the saw then fed thru the work at the desired angle — without moving the work.

Only a No. 8 MARVEL can do all of these things: Snip-off a ½" rod or cut-off an 18" x 18" cross section.

Rough to Size and Shape

Miter

Index

cut off and shape Structural Beams

Only a No. 8 MARVEL has the large T-slotted work table, with removable quick action vise, that permits accurate set-ups of work of unrestricted sizes and shapes, special fixtures; Etc.

"Rough Machine" to size and shape with minimun chip waste

The No. 8 MARVEL is the "busiest tool in the shop" wherever installed because it is a *universal* tool—has both the capacity and the versatility to handle not only standard sawing jobs but innumerable "trick" and convenience jobs as well. More than a metal saw, the No. 8 MARVEL is a fine machine tool with machine tool features like: Both power and hand feeds; Depth Stops; Automatic Blade Tension; Built-in Coolant Pump; Three operating speeds (or six with 2-speed motor). Moisture-proof electrical controls that conform to both "J.I.C." and "MACHINE TOOL" electrical standards; Dirt-proof ball bearings, etc.

If you cut, machine or fabricate metal, this is a sawing machine you should know about. Write for catalog.

MARVEL Metal Cutting SAWS
Better Machines–Better Blades

ARMSTRONG-BLUM MFG. CO. • 5700 West Bloomingdale Avenue • Chicago 39, U.S.A.

CIRCLE INFORM-A-GRAM KEY NO. 203

For Metal Cutting and Grinding Operations use Dasco D-20 heavy-duty soluble oil. It has high film strength and forms a thin, tough film between the cutting tool and the work, reducing friction and preventing excessive heating of parts, chips and tools. This soluble oil can be used for turning, reaming, drilling, boring, high-speed machining with carbides, etc. Copies of a folder with details are supplied by D. A. Stuart Oil Co., Ltd., 2727 S. Troy St., Chicago 23, or —
Circle Inform-A-Gram No. B54.

Compactness, Simplicity, Efficiency and Versatility are features of the Maxitorq electric clutch. Within rated capacities the clutch has unlimited application on machines requiring the use of single or double friction clutch drive, or brakes, or a combination of both. It is suitable for machine tool and automatic machinery drives of all kinds. For details and specifications on 8000 Series electric clutch, see a bulletin issued by The Carlyle Johnson Machine Co., Manchester, Conn., or —
Circle Inform-A-Gram No. B55.

EX-CELL-O BUSHINGS LAST TWICE AS LONG

Customer's test proves there is a difference in bushings

New tests by major equipment manufacturer proved beyond doubt Ex-Cell-O Bushings last *twice as long as other bushings!* After drilling 16,300 holes, wear on other bushing brands averaged .0039"—ready for scrap! Wear on Ex-Cell-O Bushings averaged only .0017".

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Call your Ex-Cell-O Representative or write Ex-Cell-O, Detroit. You'll get same day shipment.

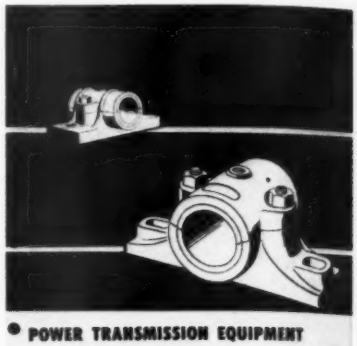
EX-CELL-O CORPORATION DETROIT 32, MICHIGAN — EX-CELL-O FOR PRECISION — XLO

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

56-58

CIRCLE INFORM-A-GRAM KEY NO. 204

Power Transmission Equipment manufactured by Standard Pressed Steel Co., Box 600, Jenkintown, Pa., is described in a four-page pamphlet, Form 2028. Covered are Pioneer steel shaft hangers, hanger bearings, split journal bearings, heavy rigid



• POWER TRANSMISSION EQUIPMENT

pillow blocks, and Hallowell solid and split cast-iron collars. Tables for each item show dimensions, weight and shaft sizes accommodated by each. Isometric drawings of shaft hangers, journal bearings and pillow blocks are also included.
Circle Inform-A-Gram No. B56.

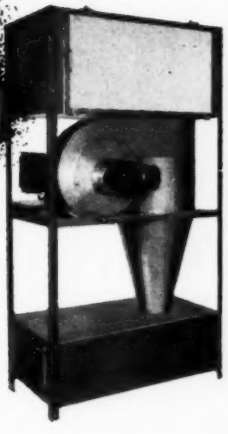
Made-To-Order Carboloy Carbide Blanks are covered in a new price list announced by Metallurgical Products Dept., General Electric Co., Detroit 32. Covered are semi and modified standard cemented carbide blanks as well as solid cemented carbide cylinders. In addition, Price List GT-314 includes "how to order" instructions and specifies shapes subject to extra charges.
Circle Inform-A-Gram No. B57.

Totally-Protected Motors have been designed for applications which formerly required drip-proof or splash-proof motors. They are guaranteed to operate within a maximum temperature rise of only 40° C. Complete details on the motors' construction features are found in Bulletin B-2501 made available by Reliance Electric and Engineering Co., Cleveland 10, or —
Circle Inform-A-Gram No. B58.

Boring Bars, Cutters and Blocks are covered in General Catalog BT57 now available from Lehmann Boring Tool, Div'n of Fulton Iron Works Co., 4235 Duncan Ave., St. Louis 10, Mo. Included are case histories, grinding data and typical shank dimensions, in addition to general and ordering information. For copies of the catalog, write to the company, or —
Circle Inform-A-Gram No. B59.

EFFICIENT–LOW COST

Dust Collection



Easy installation . . . efficient low-cost operation . . . simplified maintenance, make Dustkop *FIRST* among equipment to collect most all industrial dusts. There are Dustkop models to eliminate your dust problems . . . that are space saving, self-contained units, or exhaust type for rafter, ceiling or outside location. Write for descriptive literature.

DUSTKOP® STOPS DUST

37 STANDARD MODELS TO CHOOSE FROM

• READY TO USE

Also a Complete Line of Mist Collectors

AGET MANUFACTURING COMPANY

1394 E. CHURCH ST. • ADRIAN, MICHIGAN

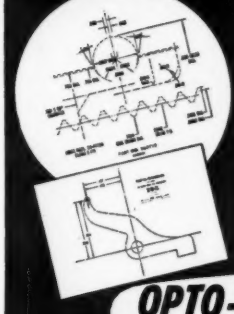
CIRCLE INFORM-A-GRAM KEY NO. 2051

Have you seen what they can do?

Wilder SMALL PARTS COMPARATOR with VERTICAL LIGHT BEAM "and" GAGE Deep-Etch COMPARATOR CHARTS

The ideal combination for the optical inspection of precision parts with contours, radii, angles.

- SPEEDS INSPECTION
- LOWERS COST
- PROMOTES EFFICIENCY



Magnifications from 10X to 150X.

ONLY $380.00 COMPLETE

FREE BOOKLET— Write for new catalog.

OPTO-METRIC TOOLS, INC.

137 TP VARICK STREET, NEW YORK 13, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 2053

The U. S. Drill Head Company's first Fixed Center Drill Head was produced for Borg and Beck, of Chicago — a subsidiary of Borg-Warner.

The 50,000th Head was shipped.

For men who know drill heads best, it's always U. S. Drill Head ...5 to 1

Since 1915, when the U. S. Drill Head Co. built its first adjustable head, it has far surpassed all other similar manufacturers because of its engineering and production facilities.

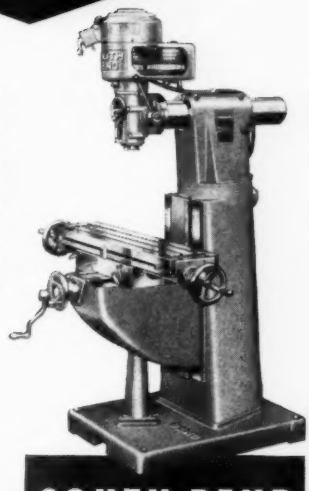
Manufacturers of all types of adjustable, fixed center and individual lead screw tapping heads.

US DRILL HEAD — THE UNITED STATES DRILL HEAD COMPANY

BURNS STREET • CINCINNATI 4, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 2052

NEW!



Exceptional versatility and accuracy enable this new milling machine to keep machining costs low on a wide variety of work. Unique design provides easy operation and ample rigidity. *Write for information.* South Bend Lathe, South Bend 22, Indiana.

SPECIFICATIONS:

Table travel.....	20" or 30"
Spindle to table..	20"
Spindle to column	20"
Spindle speeds..	8
Ram travel.....	15"
Head rotation...	360°

SOUTH BEND

VERTICAL MILLING MACHINE

SOUTH BEND

CIRCLE INFORM-A-GRAM KEY NO. 2054

HIGHER SPEEDS!
FASTER GRINDING!

kipp

AIR GRINDERS

Model JA
50,000 R.P.M.
$42.00
IN U.S.A.

Weight 12 ounces; length 6¾ inches; chuck size ⅛ inch. Wheel guard removed for better illustration.

The RPM's stay up while grinding . . . not only when the grinder runs idle. That means better work—longer wheel life.

High speed grinding with small wheels was a Madison-Kipp development of the late twenties. It was born out of a pressing need in our tool room. Because tool room grinding problems are universal, we believe it will pay you to utilize Kipp grinders in your tool room as generally as we do in our own.

kipp

MADISON-KIPP CORP.
212 Waubesa St. • Madison 10, Wis., U.S.A.
CIRCLE INFORM-A-GRAM KEY NO. 2061

RUGGED
HEAVY-DUTY
HAND CLAMPS

Knu-Vise offers rugged heavy-duty clamps, with solid bar or channel bar, and either hand or air operated, for all kinds of tough holding jobs.

In addition to their stand-up stamina for rough going, these Knu-Vise Clamps feature:

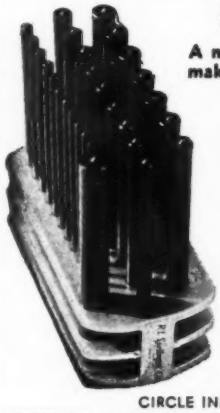
1—Easy and complete replaceability of parts
2—Hardened and ground bearing bolts
3—Minute adjustment of parts through self-locking nuts
4—Toggle Bars from C.R.S. Bars

Developments like these are typical of Lapeer engineering. More information? Write for catalog today on the models available.

Manufacturers of over 150 models of manually and air-operated clamps and pliers

KNU-VISE PRODUCTS LAPEER MANUFACTURING CO.
3064 DAVISON ROAD • LAPEER, MICHIGAN
WESTERN DIVISION: 422 Magnolia, Glendale, California • CANADIAN DIVISION: Higginson Engr., Hamilton, Ontario

CIRCLE INFORM-A-GRAM KEY NO. 2062



SPELLMACO SPOTTERS

A matched set of transfer punches for toolmakers, machinists and tool cribs.

Used for transferring location of threaded, drilled and reamed holes, slugs, blanks, etc.

Precision made of finest tool steel carefully heat treated and tempered for long life. .0025 undersize to facilitate use—black oxide finish.

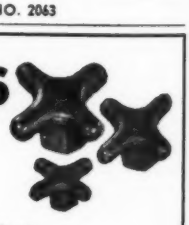
Set No. 3-17: 28 punches with indexed stand—Sizes 3/32" to ½" by 1/64" plus handy 17/32" size—length 4⅞". PRICE only $17.90

Single size available.

R. L. SPELLMAN CO. • Urbana, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 2063

HAND KNOBS



6 SIZES
CAST IRON

Tapped, Reamed or Blank.
Hex-shaped hub for extra tightening.

Write for catalog

TIETZMANN TOOL CORPORATION
Dept. HK-2 • Englewood, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 2064

Increased Production and Longer Wheel Life are features of a single end Vari-Speed snagging grinder for vitrified or high speed wheels. Model 61VS provides constant peripheral speed regardless of wheel diameter. For further information and specifications, get a catalog sheet on the grinder from The United States Electrical Tool Co., 3640 Llewellyn St., Cincinnati 23, or —
Circle Inform-A-Gram No. B60.

Setup and Inspection Devices are described and illustrated in a bulletin released by Montgomery Tools, Box 1241 Church St. Sta., New York 17. Included are angle plates; step block, punch press, and T-nut and stud sets; step and plain clamps; step blocks; and step block and clamp sets. Also detailed is the Micro-Height Gage. Copies of the bulletin are supplied by the company, or —
Circle Inform-A-Gram No. B61.

Automatically Produce Articles from Ribbon Metal with four-slide ribbon metal forming machines manufactured by The Baird Machine Co., Stratford, Conn. These machines also can be provided with straighteners, guides, etc., for operation on wire, at extra cost. For a bulletin containing details on the features of the machines and specifications, contact the company, or —
Circle Inform-A-Gram No. B62.

Surface Grinders are the subject of a bulletin from Sanford Mfg. Corp., 1020 Commerce Ave., P. O. Box 397, Union, N. J. Included are Model SG, a small parts surface grinder and Model MG, a larger, heavier duty surface grinder. The construction details, features and specifications are given for each in the illustrated bulletin. Also covered is optional equipment for the surface grinders.
Circle Inform-A-Gram No. B63.

Solid Carbide Drills and Reamers have been added to the rotary tool line produced by Elgin National Watch Co., Abrasives Div'n, Elgin, Ill. Twist drills range in size from No. 60 wire gauge to ½" dia, and reamers from 0.050" to ¾". For complete details on these new precision ground Golden Circle Tools, obtain a circular from the company, or —
Circle Inform-A-Gram No. B64.

Precision Instrument Components from stock are contained in Catalog 11 issued by PIC Design Corp., 477 Atlantic Ave., E. Rockaway, L. I., N. Y. Each item is illustrated and ordering information presented in tabular form. Included are shafts, spacers, gears, couplings, dowel pins, universal joints and gear blanks. Direct requests for the catalog to the company, or — **Circle No. B65.**

Improved Fire-Resistant Hydraulic Fluids for industrial use are the subject of the brochure, "Ucon Hydrolubes Spell Safety," issued by Carbide and Carbon Chemicals Co., Div'n of Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17. The booklet giving typical properties, advantages, laboratory pump test data, limitations, installation, maintenance, control of the fluids in use, and viscosity and alkalinity adjustment, covers Hydrolubes 150-CP and 275-CP.
Circle Inform-A-Gram No. B66.

Die Formed Standard Metal Shapes, which are being used and adapted to perform innumerable mechanical functions involving specialized design requirements, are the subject of a 24-page catalog. A code analysis and index system is used to identify the 24 different shapes. Also given is tabular data listing the hundreds of sizes and gauges which can be furnished from dies in existence. For your copy, write to The Commercial Shearing and Stamping Co., 1775 Logan Ave., Youngstown 1, O., or —
Circle Inform-A-Gram No. B67.

It's a fast service company, staffed with personnel who know that "DOWN-TIME" is "LOST-TIME". Distributors in principle cities assure IMMEDIATE DELIVERY from over 37,000 sizes in stock.

You get the finest quality in 3P HEAD PUNCHES and DIE BUTTONS, because they are made from 3 types of the finest tool steel, and are available in any DECIMAL size.

NEVER FEEL THE PINCH!
GET 3P PUNCHES AND DIE BUTTONS WHEN YOU NEED THEM.

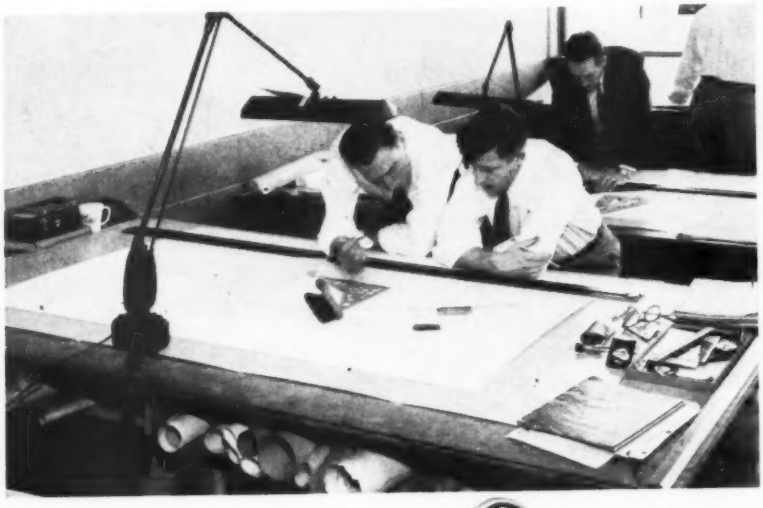
Porter Precision Products also make BAL-LOK* Punches and Die Buttons. They're always in stock and ready for IMMEDIATE DELIVERY too. Any DECIMAL size.

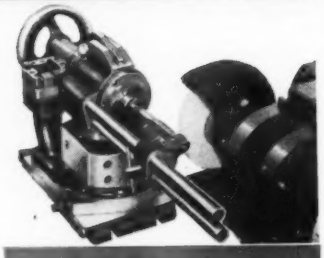
NO EXTRA CHARGE FOR FAST SERVICE, HIGH QUALITY, OR ODD SIZES.

PORTER PRECISION PRODUCTS
PRinceton 1-6338 • P.O.Box 208 • Cincinnati 15, Ohio

A Catalog of Power Tools for cutting, shaping, drilling and finishing metal, etc., has been put out by Boice-Crane Co., 963 W. Central Ave., Toledo 6, O. Included are details, specifications and illustrations of band and contour saws, band filers, cutters, shapers, drill presses and jig saws. Other tools covered are jointers, lathes, planers, belt and spindle sanders and spinning tools. Request copies of Catalog 57 from the company, or —
Circle Inform-A-Gram No. B68.

Davis Gage Components for process and design engineering are detailed in a new catalog. Covered are Models V, K and H selector guides complete with functional and engineering data. Also given for these models is general mounting data. In addition, dial indicator guides are discussed. One section is devoted to typical design applications. Letterhead requests for copies of Catalog 9 should be directed to A. G. Davis Gage & Engineering Co., Dept. TP-1, 21435 Dequindre, Hazel Park, Mich.





MONEY MAKING DECISION!

"GRIND WITH R-O FORM RELIEF". This legend appears on more and more cutting tool prints each year. A fast growing number of tool designers, tool process men and tool grinding room foremen are becoming aware of the potentials in better work and longer tool life that result from sharpening both standard and special cutters with the R-O.

Write for information and prices.

GRINDER DIVISION
Royal Oak Tool & Machine Co.
29800 Stephenson Hy. Royal Oak, Mich.

RO
UNIVERSAL FORM RELIEVING FIXTURE
R-O Grinder

CIRCLE INFORM-A-GRAM KEY NO. 208

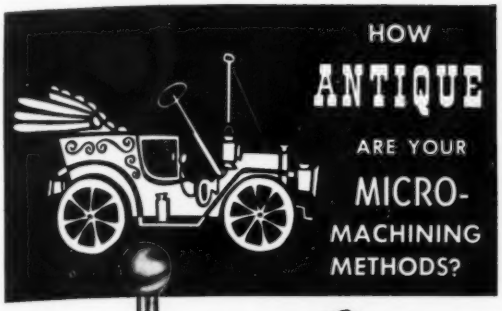
Facilitate Grinding of Inserted Blade Milling Cutters with the Ingersoll cutter grinder. A manual illustrates the wide range of usefulness of this tool and the best method of

grinding. Also included are sections on repair parts and maintenance. Also presented are specifications and a lubrication chart. The Ingersoll Milling Machine Co., Rockford, Ill., will provide copies of Manual 67, or **Circle Inform-A-Gram No. B69.**

Clean, Degrease and Rustproof Metal in one operation with Immunol, a non-flammable, odorless, nontoxic solvent. This product can be applied by wiping, dipping or spraying. A booklet details the features of the solvent and its applications, and lists the grades available. For your copy of the booklet, write to Harry Miller Corp., 4th & Bristol Sts., Philadelphia 40, or —
Circle Inform-A-Gram No. B70.

Cutting Machines are featured in Bulletin 353 released by Victor Equipment Co., 840-54 Folsom St., San Francisco 7. Described in detail are Model VU-120 universal portable flame cutting machine and Model DC-2000 Duplicutter portable shape cutting machine. Given are design, operation and construction features and accessories. Request copies of the bulletin from the company, or — **Circle Inform-A-Gram No. B71.**

Swiss High Precision Machine Tools are featured in a 12-page catalog from Carl Hirschman Co., Inc., Manhasset, N. Y. Included are Tornos automatics, Kummer dual head lathe, Hauser jig borers, jig grinders and pivot burnishers. Also found in the catalog are Schaublin lathes and milling machines, and Walter cutter grinders. Carl Hirschman Co. will release copies of the catalog, or — **Circle Inform-A-Gram No. B72.**



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ACCURACY · ECONOMY and SPEED
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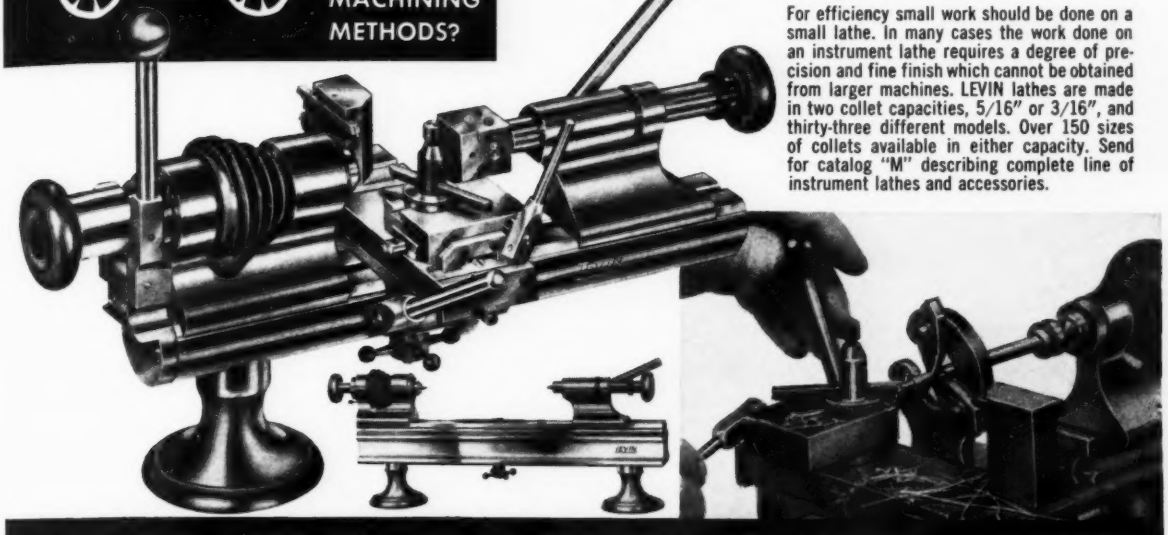
For efficiency small work should be done on a small lathe. In many cases the work done on an instrument lathe requires a degree of precision and fine finish which cannot be obtained from larger machines. LEVIN lathes are made in two collet capacities, 5/16" or 3/16", and thirty-three different models. Over 150 sizes of collets available in either capacity. Send for catalog "M" describing complete line of instrument lathes and accessories.



LOUIS LEVIN & SON, INC.—3610 S. BROADWAY—LOS ANGELES 7, CALIFORNIA

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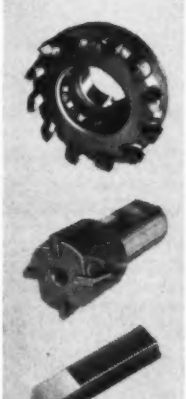
Look into the complete, cost-cutting **LOVEJOY** *line. Standard tools are in stock – to help you increase production, save time and money now!*



INSERTED-TOOTH MILLING CUTTERS
Face, side, end, slotting and boring mills.

H. S. S., CARBIDE, ALLOY BLADES
Interchangeable in all Type "A" milling cutters from 4½" to 24" in diameter.

NEW! SET-SCREW TYPE END MILLS
And new Type "Z" slotting cutters provide maximum axial and radial adjustment.

Boring Tools · Arbors · Flywheels
Lovejoy Milling Cutter · Assembly Gage

Special cutters are a Lovejoy specialty
Write for new catalogs: No. 31 (Face Mills), No. 32 (Side Mills), No. 33 (Arbors).

146 MAIN ST., SPRINGFIELD, VERMONT

Send for free **SPEED & FEED CALCULATOR**

LOVEJOY TOOL COMPANY, INC. Ltc
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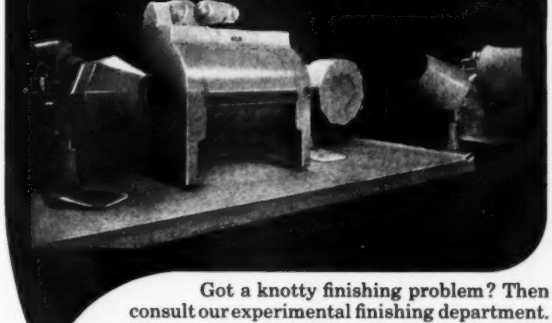


Got a knotty finishing problem? Then consult our experimental finishing department. We'll untangle it! And we'll analyze the best equipment and abrasive material for the job.

Today . . . before you invest in any finishing equipment . . . send us sample parts, a finished part for use as a guide and your specifications. We'll carry on from there. *We guarantee the same results in your plant as we get in our lab*—so how can you lose? Mail the parts and let's get started.

Globe **BARREL FINISHING EQUIPMENT**

Division **CASALBI COMPANY**
547 Wayne Street • Jackson, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 2093

For most economical threading on all Automatic Screw Machines, Chucking machines, Bolt threaders, Drill presses, etc.

H & G insert chasers

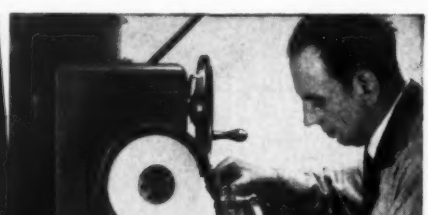
CUT YOUR COSTS AND DOWN TIME

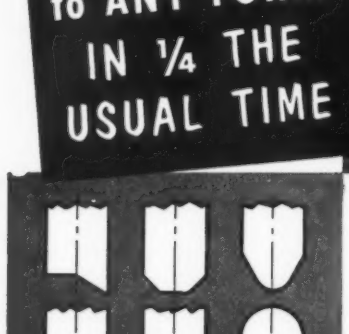
For less than $45 you get 12 sets of ¾-16 (or any stockable size) Insert Chasers; each set ground ready for business. This dozen sets can thread hundreds of thousands of parts with no down time or sharpening time. Can be thrown away when dull or if you prefer, flash grind the dull sets and make an extra profit. Threads stand critical examination and conform to the close tolerances of Class 3 fits. Send for our digest of the Government publication, "UNIFIED AND AMERICAN SCREW THREADS".

THE EASTERN MACHINE SCREW CORPORATION 29-45 Barclay St., New Haven, Conn.

CIRCLE INFORM-A-GRAM KEY NO. 2101

Precision Dress Grinding Wheels to ANY FORM IN ¼ THE USUAL TIME





The Perfex TANGI-MATIC Dresser is a self-contained precision tool built by an organization of master gagemakers for high precision work.

Any shop man who can read a "mike" can operate the dresser the first time. No Jo Blocks, no height gages or other auxiliary tools needed. All radii and angles are read directly.

Write for Descriptive Bulletin

PERFEX

PERFEX GAGE & TOOL CO.

123 AVERY ST. • MT. CLEMENS, MICH

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CIRCLE INFORM-A-GRAM KEY NO. 2102

Miccro Spray

LAY-OUT DYE

(Purple)

MICCRO Lay-Out Dye, long the leader in its field, now available in an AEROSOL package for SPRAYING.

All the advantages—instant drying; clear, sharp lines—*plus* easy-to-use, dependable, efficient MICCRO Spray container.

•

Regular MICCRO Supreme Lay-Out and Identification Dye in seven distinctive colors available as always in brush-in-cap and conventional containers.

Write for circular on company letterhead

MICHIGAN CHROME & CHEMICAL COMPANY

8615 Grinnell Ave., Detroit 13, Mich.

CIRCLE INFORM-A-GRAM KEY NO. 2103

.0003 HOLE LOCATION IN 1 MINUTE

EDGE FINDERS

$2.50 NEW POSTPAID except C.O.D. **$10.00 DELUXE**

- THOUSANDS HAVE PROVEN AND ACCEPTED THE DELUXE MODEL FOR YEARS.
- JUMPS SIDEWAYS AS SHOWN WHEN LOCATION IS REACHED.

◄ NEW .500 DIA. MODEL FOR LARGER WORK ONLY. .200 Dia.►

ADJUSTABLE VISE STOP

$2.95

HUNDREDS OF PIECES TO A .0003 TOLERANCE WITH THIS HARDENED VISE STOP THAT IS ADJUSTABLE IN ALL DIRECTIONS. ATTACH TO VISE WITH ONE ¼—20 TAPED HOLE.

Dealer Inquiries Invited

GLOVER MFG. CO.

422 Park Ave. Meadville, Penna.

CIRCLE INFORM-A-GRAM KEY NO. 2104

"The Care and Use of 430 Stainless Steel." This booklet details Type 430, a straight chromium, non-nickel bearing stainless steel. Included are physical properties, analysis, fabrication and a list of applications. Also discussed are MicroRold quality and thinness control. Write to Washington Steel Corp., Washington, Pa., for your copy of the booklet, or —
Circle Inform-A-Gram No. B73.

The 1957 Catalog is now available from Groban Supply Co., 1139 S. Wabash Ave., Chicago. Illustrated and discussed are the application and installation of hydraulic power. Also given are ideas on the modernization of equipment. Covered are new and surplus generators, hydraulics, motor pumps, valves, transformers and cylinders. Obtain copies of the catalog from the company, or —
Circle Inform-A-Gram No. B74.

Three New Non-Foaming Spray Washing Compounds have been developed by Magnus Chemical Co., Inc. X-3 Series compounds fortified with higher concentrations of wetting agent can be obtained in three strengths for hard, medium and soft metals. For complete information on these materials, obtain Bulletin 73 from Magnus Chemical Co., Inc., Dept. T & P, Garwood, N. J., or —
Circle Inform-A-Gram No. B75.

Spray Valves are highlighted in Bulletin 60-A published by The Farval Corp., 3290 E. 80th St., Cleveland 4. Also described are manual and automatic spray lubrication systems. They are used in centralized lubrication of heavy industrial gearing and slide surfaces. In addition, the illustrated bulletin notes some engineering considerations. Get your copy from the company, or —
Circle Inform-A-Gram No. B76.

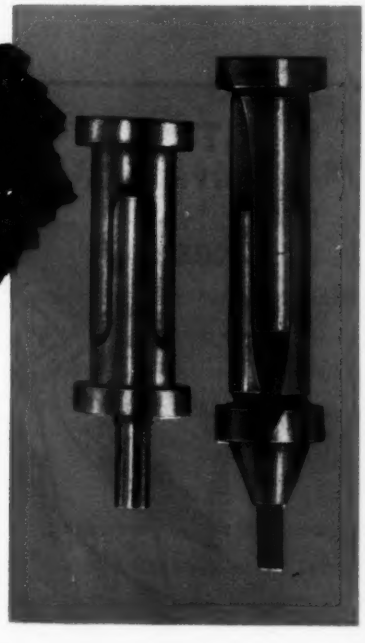
Fully Automatic Precision Spindle Positioning is a feature of the coordinate Boring and Milling Machine KBF2. This machine is suited for single, batch and mass production. The machine's advantages, features and specifications are found in a catalog illustrated with photos and diagrams. For your copy, contact Marac Machinery Corp., 45 S. Broadway, Yonkers, N. Y., or —
Circle Inform-A-Gram No. B77.

Flexon Flexible Metal Hose is featured in Catalog 152 from Flexonics Corp., 1315 S. 3rd Ave., Maywood, Ill. Each type is shown complete with construction, applications and specifications. In addition, several typical applications and hose assemblies are pictured. Also given is information on hose selection. The company will provide copies of the catalog, or — **Circle No. B78.**

Loads Up To 300 Lbs can be manipulated by the Controlex push-pull remote control. This control eliminates the disadvantages of mechanical push-pull controls—friction loss, backlash, limited length, and limited load. A folder listing the advantages, giving technical data and showing the use of the Controlex over long distances can be obtained from Controlex Corp. of America, Bldg. 11, Westchester County Airport, Hangar 18, White Plains, N. Y.,
Circle Inform-A-Gram No. B79.

A Hydraulic Plate Shear is described in detail in Catalog 305 from Pacific Industrial Mfg. Co., 848—49th Ave., Oakland 1, Calif. Included is complete data on controls and construction and a dimensions chart. The plate shear is designed to cut nonferrous metals, stainless steels, high carbon steels and armor plate in lengths up to 30 ft. It will reduce setup, handling and maintenance time to a minimum. For complete information, see the catalog provided by the company, or —
Circle Inform-A-Gram No. B80.

The Ability to Serve Many Needs...



DURABLE
Sleeve Supported
PERFORATORS

For Spring-Loaded Or Solid Stripper Designs

Get greater productivity and LONGER LIFE with Durable Sleeve Supporter Perforators. Punch holes easier, faster and more accurately in SOFT and HARD, THICK and THIN materials. You get positive alignment, closer clearances and burr-free holes. Durable Perforators DO NOT BREAK because they are supported throughout the full stroke by the intermeshing sleeves.

Durable Perforators, Vertically Lapped, and Electrocoted, strip easier, eliminate galling and REDUCE PRESS DOWNTIME.

IF IT'S DURABLE IT'S DEPENDABLE

Two decades of punching know-how assures you practical answers to your perforating problems. Ask for our new Durable Catalogue, and Engineers Handbook. It's FREE.

Patented and made exclusively by
DURABLE PUNCH & DIE COMPANY
1214 W. Madison Street, Chicago 7, Illinois

A Steel Tube Fittings Catalog has been published by The Weatherhead Co., Customer Service Dept., Fort Wayne Div'n, 128 W. Washington Blvd., Fort Wayne, Ind. Engineering Data is given on 7000 Series and 8000 Series Ermeto hydraulic flareless tube fittings and Flare-Twin SAE 37° flare hydraulic tube fittings. One section is devoted to assembly instructions, materials, finishes and operating pressures. The company will issue copies of the 48-page catalog, or —
Circle Inform-A-Gram No. B81.

The Romine Single-Pass Acme Tap is featured in a 4-page bulletin made available by Horspool & Romine Mfg. Co., Inc., 5850 Marshall St., Oakland 8, Calif. Given is a complete list of stock sizes from ⅜" to 2½" dia. Among the advantages of the Romine acme tap are increased production, improved threads and fewer rejects. Also noted in the bulletin are a few of the unusual tapping jobs handled by the tap. For copies of the bulletin, contact the company, or —
Circle Inform-A-Gram No. B82.

WHAT . . .
NO UNIVERSAL DRILL BUSHINGS?

Wherever there are holes to drill using jigs or fixtures, it pays to specify Universal drill bushings. Machined from finest quality steel, Universal bushings have super-finished bores which lengthen tool life and reduce bushing wear over long production runs. Knurled heads provide quick, sure grip. Blended radii on top-inside diameters help prevent tool hang-up and breakage. Standard sizes and lengths in stock for immediate delivery.

FREE UNIVERSAL SELECTOR. Gives all engineering data for selection of all types and sizes of drill bushings up to 1¾" drill size. Send request on your company letterhead.

UNIVERSAL ENGINEERING CO. FRANKENMUTH 8, MICHIGAN

198

CIRCLE INFORM-A-GRAM KEY NO. 212

The Design and Manufacturing Advantages of cold headed fasteners and parts are covered in a 4-page catalog. Illustrated and discussed are the many design possibilities in rivet, nail and threaded part manufacture by the cold heading or cold forging process. John Hassall, Inc., Westbury, L. I., N. Y., will provide copies of the catalog, or —
Circle Inform-A-Gram No. B83.

Specifications, Properties and Uses of Metal Powders are found in Bulletin 561 issued by Metals Disintegrating Co., Inc., Elizabeth, N. J. Each of the standard grades is listed with minimum purity, approximate screen analysis and apparent density given, in addition to end uses. Obtain your copy of the bulletin from the company, or —
Circle Inform-A-Gram No. B84.

Three Types of Safe-Torque Tap Drivers are described in Bulletin 20-50 recently issued by Scully-Jones and Co., 1901 S. Rockwell St., Chicago 8. They are designed to increase tap life and production. Covered are tension and compression, standard, and quick-change drivers. Each tap driver is pictured and discussed, complete with specifications.
Circle Inform-A-Gram No. B85.

Easier, Quicker Setups are possible with Universal vises and work holding fixtures. A catalog details 3-way, machine, mill and quick-acting vises; a lathe fixture; an angle plate; work holders and Man-Sized parallel clamps. Universal Vise & Tool Co., Parma, Mich., will make available copies of Catalog 9156 containing complete information, or —
Circle Inform-A-Gram No. B86.

Case Histories are employed to show the wide variety of jobs that the No. 2 Process electrostatic spray painting can handle, in a brochure from Ransburg Electo-Coating Corp., Barth and Sanders Sts., Indianapolis 7. In addition, the process is explained, its results noted and the scope detailed. For complete information, obtain copies of the brochure from the company, or — **B87.**

Rapid, Accurate Drilling of Large Numbers of Holes in terminal boards or printed-wiring boards is performed by a semi-automatic drilling machine. Type 3005 Pantodrill drills an average of 150 holes in a board in 1 to 2 min. For details, specifications and features, get a bulletin from Allen B. Du Mont Laboratories, Inc., 760 Bloomfield Ave., Clifton, N. J., or — **Circle No. B88.**

You Can Rely on a **ROUSSELLE**

THESE 40-TON PRESSES take job after job in stride and give you top speed and uniform output on a variety of work. They stress simplicity in every detail to achieve quicker set-ups, easier changeovers and simpler operation. All are extra rugged, high precision units, made to withstand hard usage and assure long, satisfactory service. They are *very moderately priced.*

Manufacturers of Rousselle Presses

Significant savings may result if you let our engineering staff assist you. There is no obligation.

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Rousselle Presses are sold exclusively through leading machinery dealers.

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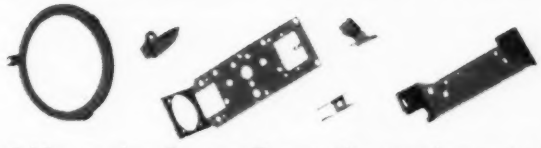
Choice of 25 models in 5 to 40-ton sizes.

SERVICE MACHINE CO. 2310 West 78th Street • Chicago 20, Ill.

CIRCLE INFORM-A-GRAM KEY NO. 2131

STAMPINGS - - - SHORT RUNS



A dependable service for small quantity requirements for new developments and production up to 50,000 pieces. QUICK DELIVERY — ACCURACY — backed by 25 years' experience.

SMALL LOT STAMPING CO.

Linden 3-3700 "Dedicated to Short Runs" 1025 W. Blancke St. Linden, New Jersey

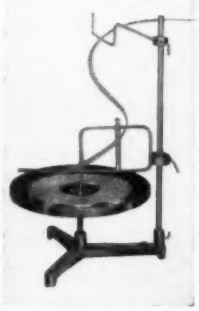
CIRCLE INFORM-A-GRAM KEY NO. 2132

economically priced press room equipment

DURANT Automatic Stock Reels

Operates by natural spring of uncoiling stock. Priced from $85.00. Nine other models of stock reels in vertical, horizontal, motorize or automatic types for all applications.

Manufacturers of Stock Reels, Roll Feeds, Straighteners, Scrap Choppers, Die Pullers, Foot Presses, Coil Cradles, Press Guards, Stock Oilers.



WRITE FOR NEW FREE CATALOG

DURANT TOOL SUPPLY CO.

PROVIDENCE 3, RHODE ISLAND

CIRCLE INFORM-A-GRAM KEY NO. 2133

STAGGER TOOTH WOODRUFF CUTTERS

- STANDARD STOCK ITEM
- STANDARD PRICES
- SMOOTHER CUTTING
- LONGER LIFE

Recommended for cutting tough, hard to machine materials.

Agents' and Jobbers' Inquiries Welcome

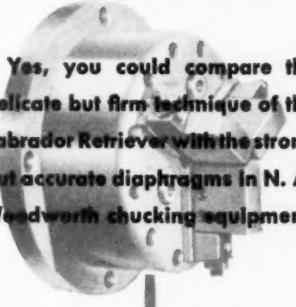
QUALITY TOOL WORKS

785 S. Market St., Waukegan, Ill.

CIRCLE INFORM-A-GRAM KEY NO. 2134

HOLD IT!

WITH WOODWORTH CHUCKING EQUIPMENT



Yes, you could compare the delicate but firm technique of the Labrador Retriever with the strong but accurate diaphragms in N. A. Woodworth chucking equipment.

Your best machine will produce only as accurately as its work-holding device permits and Woodworth manufactures the most rugged, accurate and dependable chucks for precision machining in America.

We invite your inspection and consideration of Woodworth chucking equipment.

- Standard Diaphragm Chuck
- Air-Operated Diaphragm Chuck
- Bevel Gear Chuck
- Double Diameter Gear Chuck
- Finger Chuck
- Air-Operated Diaphragm Arbor
- Push-Lock Arbor
- Twist-Lok Spline Arbor
- Tork-Lok Collet Arbor
- Zero Spindle Inspection Fixture

"Accuracy you can trust"

WOODWORTH

1300 East Nine Mile Road

Detroit 20, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 2135

MEN YOU SHOULD KNOW

A. O. Smith Corp. has named two vice presidents, **U. T. Kuechle** and **Roy A. Dingman. James F. Jones** has become manager of the firm's Automotive and Railroad Products Divisions.

◆

Bernard S. Reckseit has been made chief engineer of Ransohoff, Inc. He assumes this position following the death of **Nathan Ransohoff,** chairman of the board and chief engineer.

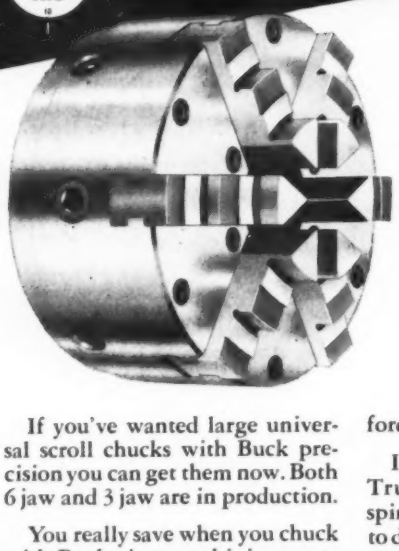
The appointment of **Roy P. Trowbridge** as director of the Engineering Standards Section of General Motors Corp. has been disclosed. He succeeds **William L. Barth** who has been transferred to another assignment.

◆

T. S. Pacer, E. B. Smiley and **G. P. Sullivan** are the three vice presidents recently elected by Illinois Gear & Machine Co. Each of these men has served the company for over 20 years.

Now – Buck Precision and Savings in 10″ and 12″ Chucks

AJUST-TRU



Dead True Precision Within One Minute

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Compensate For Wear As You Adjust

If you've wanted large universal scroll chucks with Buck precision you can get them now. Both 6 jaw and 3 jaw are in production.

You really save when you chuck with Buck. Any machinist or set-up man can adjust a Buck to dead true in 1 minute. Inexperienced operators can then chuck duplicate parts within .0005″ precision without further adjustment. You have never had such precision before with universal scroll chucks.

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BUCK TOOL COMPANY

218 SCHIPPERS LANE • KALAMAZOO, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 214

Russell S. Rockafellow has been appointed director of production engineering on the manufacturing staff of Chrysler Corp. He succeeds **Otto W. Franke,** who recently retired. **William O. Collins** has been named manager of the By-Products Department in the company's central purchasing. He succeeds **George B. Wells** who has retired after 35 years with the company. Mr. Collins will be in charge of the sale, disposal or inter-plant transfer of all corporate surplus or obsolete buildings, machinery, equipment, and materials.

◆

John R. Dingle has been appointed vice president in charge of manufacturing for both The Cleveland Worm and Gear Co. and its affiliate, The Farval Corp. **Sidney L. Eastman** has taken over as vice president in charge of engineering for Cleveland Worm & Gear. He has been associated with the firm since 1927.

◆

Five promotions have been announced by General Precision Laboratory Inc. **Dr. Raymond L. Garman** has been elected to the new position of executive vice president and technical director and **James W. Murray** to executive vice president and general manager, another new post. **Richard W. Lee** and **William J. Tull** have been named vice presidents. The new president of Pleasantville Instrument Corp., GPL's manufacturing subsidiary, is **William P. Hilliard.**

◆

Henry F. Dever, president of Brown Instruments Division of Minneapolis-Honeywell Regulator Co., has been given corporate responsibility for directing the parent company's activities in the industrial controls field. He will be in charge of over-all planning and will counsel and coordinate the engineering and manufacturing operations of seven M-H divisions now active in this field.

◆

The newly-created position of deputy general manager for operations at the Electronics Division of American Machine & Foundry Co. is being filled by **Robert W. Pearson.** In this post, he will be responsible for the operation of the Engineering, Manufacturing, Materiel and Quality Control Departments. The new assistant to the company's executive vice president is **Clayton DuBosque, Jr.**

◆

Richard F. Shelley recently became associated with Van Norman Machine Co. as chief electrical engineer.

◆

Louis B. Stoner has been made a director of Chicago Pneumatic Tool Co. He succeeds **L. F. Hoffman** who has resigned.

MEN YOU SHOULD KNOW

The election of **Henry M. Haase** as vice president in charge of engineering and research for Borg-Warner Corp. has been made known. In his new capacity he will direct the corporation's expanding program of product planning and engineering research and development. Included in his duties is general supervision over the newly built Research Center in Des Plaines, Ill., and the Petro-Mechanics Research Division in Los Angeles.

◆

J. S. Gillespie is serving as manager of engineering for the Metallurgical Products Department of General Electric Co. In addition to his new duties, he will continue as acting manager of the industrial diamond project. Mr. Gillespie joined GE in 1936.

◆

The new assistant to the president of Heli-Coil Corp. is **John Rabuse.** He has been associated with the firm since 1945. **Leo J. Brancato** has taken over as a vice president. He will continue to head the Engineering Department along with his new corporate duties.

◆

John R. Duffy has been named chief engineer for Lindberg Engineering Co. In addition to directing activities of an expanded engineering department, he will be responsible for the design of the company's complete line of heat treating furnaces, kilns and high vacuum heating equipment.

◆

W. E. Staff, Jr. is serving as applications engineer for J. B. Rea Co. Before joining this firm, he had been with Logistics Research, Inc.

◆

The Spring Division of Crucible Steel Co. of America has named **Charles E. Knox** as manager of the newly created Process Engineering and Production Control Department. This department is responsible for steel procurement, inventory control, scheduling, standard processing methods, and industrial engineering functions.

◆

Jacob J. Jaeger and **Albert L. Knapp** have been elected to the board of directors of Pratt & Whitney Co., Inc. A vice president named at the same time is **Harry Reichert.**

◆

Appointment of **Herbert I. Chambers** as assistant chief development engineer for Consolidated Electrodynamics Corp. has been disclosed. **Frank C. Bumb** will succeed Mr. Chambers as supervisor of the electro-mechanical development group.

◆

Max C. Farmer is filling the newly-created position of technical director for The Beryllium Corp.

The election of **Kempton Dunn** as chief executive of American Brake Shoe Co. has been disclosed. He succeeds **William B. Given, Jr.** who will continue actively as chairman of the board. Mr. Dunn will carry on an active program of diversification.

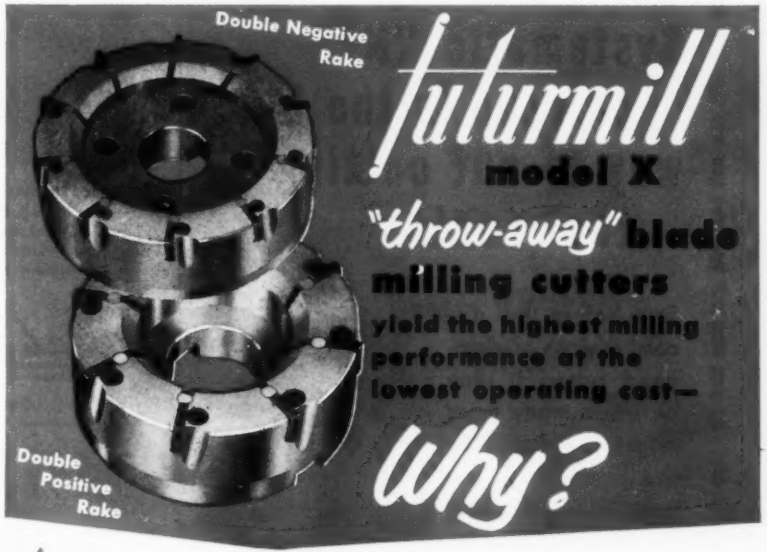
◆

Kenneth W. Donle has taken over as manager of product engineering for Tube Reducing Corp. In his new position, he will also be responsible for new product development.

James P. Haight has become vice president in charge of engineering and purchasing for Aluminum Co. of America, succeeding **Thomas D. Jolly** who has retired.

◆

The new president of Stackpole Carbon Co. is **H. S. Conrad,** succeeding **Lyle G. Hall. A. A. Haberberger** has been named vice president and general works manager and **E. J. Hammer,** vice president and director of industrial relations.



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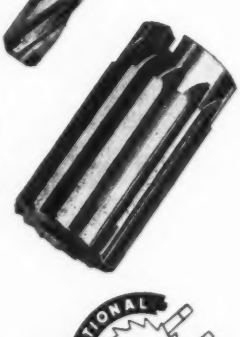
Systematic "NTS" salvage is the best way to cut cutting tool costs

Stop before you discard a worn or damaged cutter. It may be worth many times its scrap value!

Since 1912 we have been restoring all kinds of cutting tools to new usefulness to help shops control their cutter costs.

Can we assist you in studying your operations and tool usage to determine if a salvage program will save money in your plant? There is no obligation.



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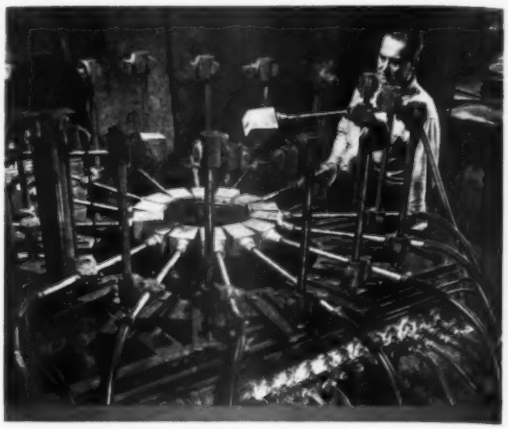
Selective Radiant Gear Hardening

This Lakeside patented machine does a better job, faster on parts such as gears, wheels or sprockets. Spun at controlled speeds, the multiple gas torches cover all surfaces — missing none. This machine plus other units for spinning or progressive flame hardening enables Lakeside to process varieties of machine parts. Give us a call TODAY!



Our Services: Electronic Induction Hardening, Carbonitriding, Flame Hardening, Heat Treating, Bar Stock Treating and Straightening (mill lengths and sizes), Annealing, Stress Relieving, Normalizing, Pack, Gas or Liquid Carburizing, Nitriding, Speed Nitriding, Aerocasing, Chapmanizing, Cyaniding, Sand Blasting. Laboratory Physical Testing.

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to resist stress, wear and vibration

They increase product durability at low initial cost

Simple one piece design — no inserts — no outside devices. Nothing complicated — the Gripco locking action is within the nut itself, yet you get low initial cost and low application cost with increased customer satisfaction. Speed production and lower manufacturing costs on your products now.

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all with or without the famous Gripco positive locking feature. Also Standard Semi-Finish Nuts.

115

GRIP NUT COMPANY

107 Maple Ave. • South Whitley, Ind.

CIRCLE INFORM-A-GRAM KEY NO. 2163

GROWING PAINS

Plans for extensive new building additions at **The Skinner Chuck Company** have been disclosed. Production and storage space totalling 20,000 sq ft, and 6,500 sq ft of space for the expanding engineering department, will be added to the present building.

◆

New plant facilities including 15,000 sq ft of manufacturing floor space and about 5,000 sq ft of office space will be erected by **Dearborn Gage Company** near Detroit. The new building will be ready for occupancy by mid-spring. The company manufactures precision gages, gage blocks, and gaging jigs, fixtures and accessories.

◆

A two-year expansion and modernization program is underway at the Wright-Manley facilities of **American Chain & Cable Company, Inc.** The first phase of the project is a new 20,000-sq-ft receiving and raw stores building. The program will also include many physical changes in several buildings.

◆

Clary Corporation will open a new major factory at Searcy, Ark. Production lines for adding machines and cash registers will be transferred from the San Gabriel, Calif., plant to Searcy where a factory for initial production will be ready in May. This move will result in more plant capacity needed at San Gabriel for new production. The company makes business machines, electronic equipment and missile and aircraft components.

◆

Link-Belt Company will build a new plant in Montebello, Calif., to replace and expand its facilities now located in Los Angeles. Ground will be broken in the spring and the plant is expected to be completed and in operation by November. The new factory will more than double the company's present manufacturing facilities and will also house the factory branch store and district sales office.

◆

A new plant will be constructed to house the Warner Automotive Parts Division of **Borg-Warner Corporation.** Scheduled to be started in the spring, this structure will in part consolidate under one roof production operations now occupying several buildings.

A new plant housing the special products grinding department has been opened by **Kennametal Inc.** near Latrobe, Pa. It provides 24,000 sq ft of floor space and employs about 100 men.

◆

A multi-million dollar plant is being erected in Van Wert, Ohio, by **The Carborundum Company** for the manufacture of high volume, small abrasive wheels. This plant is part of the company's $30,000,000 modernization and expansion program scheduled for 1957 and 1958.

American Can Company has begun expansion programs at two East Coast plants and has completed a major renovation job at a third. Involved are Canco's Hillside, N. J., Needham, Mass., and Baltimore, Md., plants which produce a total of as many as 1.9 billion containers a year. The packing and shipping facilities at the Baltimore plant have been renovated. At the plant in Needham, high-speed equipment for manufacturing beverage cans is being installed. Construction of a plant addition for handling steel and tin plate in continuous strips has been started at the Hillside factory.

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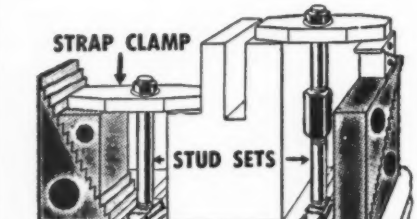

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For stacking coiled material. Four-way entry, for fork truck, open ends for ram-type deposit of coils. Nesting caps insure fast easy stacking.

PORTABLE BAR RACKS

For safer stock transport. Unique crane grab permits load centering and rapid fool-proof engagement. Automatic grab also available.

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Manufacturers of Portable Storage Racks, Steelmobile, Scrapmobile

CIRCLE INFORM-A-GRAM KEY NO. 2185

Frank W. Taylor Co. is serving as sales representative for the line of AC and DC subfractional, servo and gear motors; fans; blowers and dynamotors produced by Induction Motors Corp. of Westbury, L. I., N. Y. The Taylor organization will cover New York, New York City and Long Island.

◆

The new manager of the Special Product Sales Department of Universal-Cyclops Steel Corp. is **S. Allen Oviatt.** He will be in charge of sales of the Turbine Blading Department, in addition to other special products. **William L. Bruckart** has been transferred to this department. His activities in the development of molybdenum metal and refractory alloys will be integrated with other special product sales development.

◆

The promotion of **Paul N. Stanton** to the position of sales manager has been announced by **Joseph P. Crosby,** vice president-sales, The Lapointe Machine Tool Co. The company produces broaching machines, fixtures and tools.

◆

Two branch offices in the middle western and eastern states have been opened by True-Trace. **Dan E. Harrison** is in charge of the midwest office in Racine, Wis. The New York office located in New Cassel, L. I., will be headed by **Len Dubuke.** True-Trace engineers and manufactures hydraulic tracing controls for metal cutting machines.

◆

James H. Bray has been appointed manager of the Roll Department at Birdsboro Steel Foundry and Machine Co. He will be responsible primarily for sales and service in the Eastern, Buffalo, and Canadian steel districts. He is succeeded in the Pittsburgh area as roll sales representative by **William L. Van Winkle.**

◆

The new sales manager for The Atrax Co. is **Herbert W. Fichtner.** His new duties cover sales liaison and coordination with Atrax distributors throughout the United States and several foreign countries.

◆

Hannifin Corp. has named divisional managers to handle its sales operations. They are **Robert G. Broberg** for the air and hydraulic Power Cylinder Division; **William C. Thompson,** Air Valve Division; and **Arnold W. Blackshaw,** Machinery Division, including air and hydraulic presses and portable hydraulic power tools.

Joseph S. Gowdy has taken over as district representative in Texas and Oklahoma for Heppenstall Co., succeeding **Charles A. Fischer.** The district office is in Houston.

◆

In furtherance of its plan to establish nationwide distribution for oxide cutting tools, Diamonite Products Mfg. Co., a division of U. S. Ceramic Tile Co., Canton, Ohio, has made known the appointment of sales representatives in Arizona and the St. Louis area. They are Harwood Industries in Phoenix, Ariz., and Carbide Engineering Service in Jennings, Mo.

The Abrasive Division of Elgin National Watch Co. has disclosed the appointment of **Roy Zahn** as sales engineer in six states of the New England region. He will operate from offices in Hartford, Conn., handling sales of the company's line of diamond compound, carbide rotary tools and Elgiloy, a non-corrosive spring alloy.

◆

Reginald Kennard is serving as field sales representative for the Industrial Division of Warner Electric Brake & Clutch Co. He will headquarter in the Washington, D. C. area.

"CENTURY-DETROIT SELLS PRODUCTION"

don't put up with high-cost operations in either machining, assembly or inspection!

forge ahead of competition—have Century-Detroit automate your production.

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We design and build machines that automatically handle the part, or casting, through all the machining operations—ready for assembly.

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We design and build high production assembly machines, handling all components automatically.

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Parts or assemblies can be inspected automatically in separate machines or the inspection operations may be incorporated into the Machining or Assembly Machines.

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We design & build—design only or—build only.

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CIRCLE INFORM-A-GRAM KEY NO. 219

*CERTIFIED . . . "up to 3,450 lbs. of clamping force"

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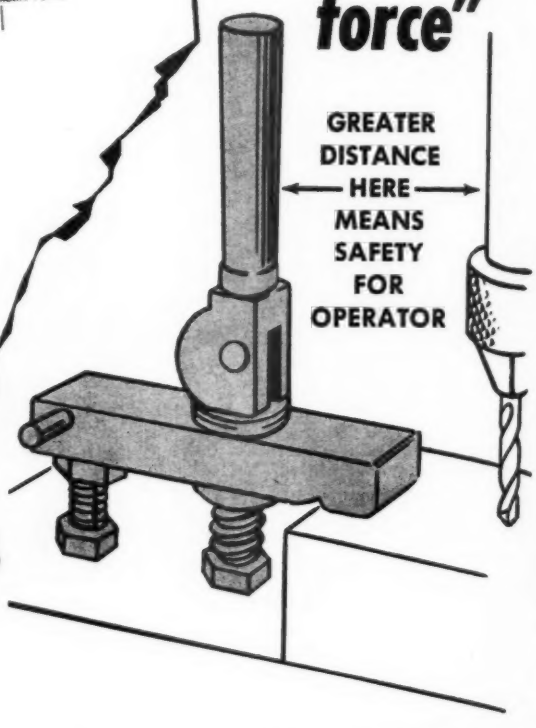
Without the use of any auxiliary equipment, it was found that a man could exert up to 3,450 pounds, by bringing the lever to a position 90° with the Eye-Bolt.



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STANDARD'S DOUBLE ½" (500) CAM LEVER

This Double Cam Lever offers superior design and engineering features—assuring greater safety, performance, strength and durability.

- **Maximum Job Clearance.**
- **Safe Operation—with handle *vertical* before clamping (as illustrated).**
- **Constant Maximum Clamping Pressure—perpendicular to center line of lever.**
- **Certified 6-Ton Back-Pressure Resistance—no danger of cam backing up.**
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- **This cam can be applied to your specially designed assemblies. Quotations on request.**

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CIRCLE INFORM-A-GRAM KEY NO. 220

INFORM-A-GRAM

FEBRUARY 1957 ISSUE

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5	25	45	64	131	150	171	204	239	1721	1932	2011	2064	2183	2304	2421	2571	
6	26	47	65	132	151	173	207	240	1722	1933	2012	2091	2184	2331	2422	2572	
7	27	48	66	133	152	174	208	243	1723	1934	2013	2092	2185	2332	2423	2573	
8	28	49	67	134	153	175	211	244	1724	1935	2014	2093	2251	2333	2451	2574	
9	29	50	68	135	154	177	212	247	1761	1941	2015	2101	2252	2334	2452	2575	
10	31	51	69	136	155	178	214	248	1762	1942	2016	2102	2253	2341	2453	2576	
11	32	52	70	137	156	181	215	251	1791	1943	2021	2103	2254	2342	2454	2581	
12	33	53	72	138	157	182	217	252	1792	1944	2022	2104	2255	2343	2461	2582	
13	34	54	121	139	158	185	219	253	1793	1945	2023	2131	2261	2371	2462	2583	
14	35	55	122	140	159	186	220	255	1831	1961	2024	2132	2262	2372	2463	2584	
15	36	56	123	141	161	187	221	256	1832	1962	2025	2133	2263	2373	2491	2585	
17	37	57	124	142	162	191	224	259	1833	1963	2051	2134	2291	2381	2492	2611	
18	38	58	125	143	165	192	227	263	1834	1964	2052	2135	2292	2382	2493	2612	
19	39	59	126	145	166	195	228	264	1841	1965	2053	2161	2293	2383	2494	2621	
20	40	60	127	146	167	197	231	1601	1842	1981	2054	2162	2294	2384	2501	2622	

EDITORIAL ITEMS

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A3	A21	A39	A57	A75	A93	B17	B35	B53	B71	C1	F8
A4	A22	A40	A58	A76	A94	B18	B36	B54	B72	C2	F9
A5	A23	A41	A59	A77	B1	B19	B37	B55	B73	C3	F10
A6	A24	A42	A60	A78	B2	B20	B38	B56	B74	C4	
A7	A25	A43	A61	A79	B3	B21	B39	B57	B75	C5	
A8	A26	A44	A62	A80	B4	B22	B40	B58	B76	C6	
A9	A27	A45	A63	A81	B5	B23	B41	B59	B77	C7	
A10	A28	A46	A64	A82	B6	B24	B42	B60	B78	C8	
A11	A29	A47	A65	A83	B7	B25	B43	B61	B79	C9	
A12	A30	A48	A66	A84	B8	B26	B44	B62	B80	C10	
A13	A31	A49	A67	A85	B9	B27	B45	B63	B81	D1	
A14	A32	A50	A68	A86	B10	B28	B46	B64	B82	F1	
A15	A33	A51	A69	A87	B11	B29	B47	B65	B83	F2	
A16	A34	A52	A70	A88	B12	B30	B48	B66	B84	F3	
A17	A35	A53	A71	A89	B13	B31	B49	B67	B85	F4	
A18	A36	A54	A72	A90	B14	B32	B50	B68	B86	F5	

Which article in this issue was of most interest to you? _____

THESE INFORM-A-GRAM CARDS are for the convenience of *TOOLING and PRODUCTION* readers who, we know, rarely have stenographic help at their beck-and-call while reading. To get further information concerning selected items featured — all one needs is an INFORM-A-GRAM card and a pencil or pen to circle the numbers of the items wanted. If there is no identifying number, use the page number.

Our reader service department is handling over 100,000 reader inquiries per year and it is essential that the blanks at the top of each card be filled in accurately and completely. Please use only one of these INFORM-A-GRAM cards for yourself and let one of your associates use the other.

INFORM-A-GRAM

FEBRUARY 1957 ISSUE

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4	24	44	63	130	149	170	203	236	1632	1931	1984	2063	2182	2303	2413	2504	
5	25	45	64	131	150	171	204	239	1721	1932	2011	2064	2183	2304	2421	2571	
6	26	47	65	132	151	173	207	240	1722	1933	2012	2091	2184	2331	2422	2572	
7	27	48	66	133	152	174	208	243	1723	1934	2013	2092	2185	2332	2423	2573	
8	28	49	67	134	153	175	211	244	1724	1935	2014	2093	2251	2333	2451	2574	
9	29	50	68	135	154	177	212	247	1761	1941	2015	2101	2252	2334	2452	2575	
10	31	51	69	136	155	178	214	248	1762	1942	2016	2102	2253	2341	2453	2576	
11	32	52	70	137	156	181	215	251	1791	1943	2021	2103	2254	2342	2454	2581	
12	33	53	72	138	157	182	217	252	1792	1944	2022	2104	2255	2343	2461	2582	
13	34	54	121	139	158	185	219	253	1793	1945	2023	2131	2261	2371	2462	2583	
14	35	55	122	140	159	186	220	255	1831	1961	2024	2132	2262	2372	2463	2584	
15	36	56	123	141	161	187	221	256	1832	1962	2025	2133	2263	2373	2491	2585	
17	37	57	124	142	162	191	224	259	1833	1963	2051	2134	2291	2381	2492	2611	
18	38	58	125	143	165	192	227	263	1834	1964	2052	2135	2292	2382	2493	2612	
19	39	59	126	145	166	195	228	264	1841	1965	2053	2161	2293	2383	2494	2621	
20	40	60	127	146	167	197	231	1601	1842	1981	2054	2162	2294	2384	2501	2622	

EDITORIAL ITEMS

A1	A19	A37	A55	A73	A91	B15	B33	B51	B69	B87	F6
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A3	A21	A39	A57	A75	A93	B17	B35	B53	B71	C1	F8
A4	A22	A40	A58	A76	A94	B18	B36	B54	B72	C2	F9
A5	A23	A41	A59	A77	B1	B19	B37	B55	B73	C3	F10
A6	A24	A42	A60	A78	B2	B20	B38	B56	B74	C4	
A7	A25	A43	A61	A79	B3	B21	B39	B57	B75	C5	
A8	A26	A44	A62	A80	B4	B22	B40	B58	B76	C6	
A9	A27	A45	A63	A81	B5	B23	B41	B59	B77	C7	
A10	A28	A46	A64	A82	B6	B24	B42	B60	B78	C8	
A11	A29	A47	A65	A83	B7	B25	B43	B61	B79	C9	
A12	A30	A48	A66	A84	B8	B26	B44	B62	B80	C10	
A13	A31	A49	A67	A85	B9	B27	B45	B63	B81	D1	
A14	A32	A50	A68	A86	B10	B28	B46	B64	B82	F1	
A15	A33	A51	A69	A87	B11	B29	B47	B65	B83	F2	
A16	A34	A52	A70	A88	B12	B30	B48	B66	B84	F3	
A17	A35	A53	A71	A89	B13	B31	B49	B67	B85	F4	
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Which article in this issue was of most interest to you? _____

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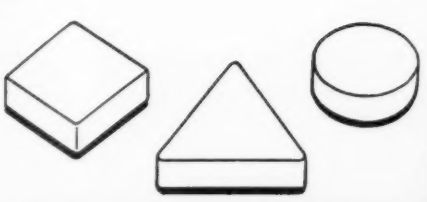
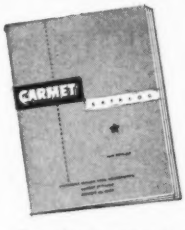


CARMET

CA-610 THROW-AWAY TOOL BLANKS improved this cutting operation 150%

Write for the NEW CARMET CATALOG



. . . Completely revised, the 16th Edition of the Carmet Catalog contains the latest information on all Carmet grades, and on Carmet blanks, tools, die sections, etc.; also gives details on special preforming and how to order special parts.

Address Dept. TP-86

A leading West Coast manufacturer now uses Carmet CA-610 tool blanks for machining components of jet engines and gas turbines. Since switching to this special steel-cutting carbide grade, production has sharply increased from 28 parts per blank *to more than 80.*

Carmet throw-away blanks are designed for any type of tool holder. This same manufacturer reports that the ease and speed with which used blanks may be exchanged for new ones has reduced downtime for tool change-over by 7%.

Advantages such as these are important in *your* industry, too. Call your Carmet dealer TODAY for his advice on any production problems you may have . . . or write *Allegheny Ludlum Steel Corporation, Carmet Division, Detroit 20, Mich.*

For ALL your CARBIDE needs, call

Allegheny Ludlum

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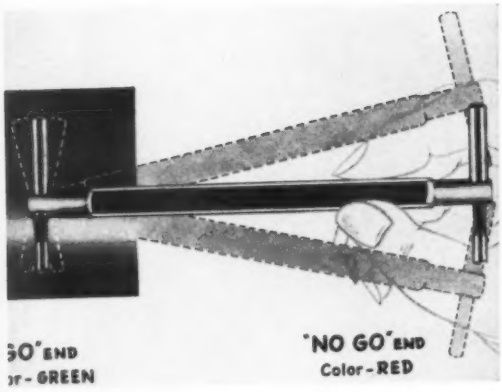
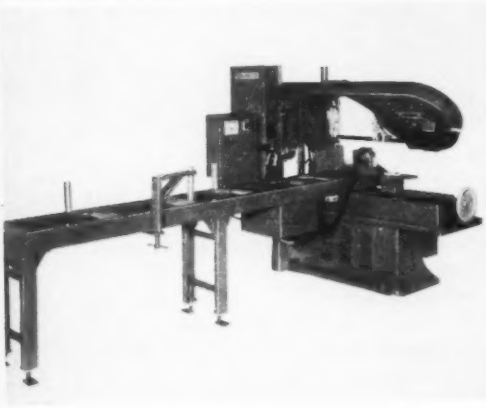


HOLE GAGE . . .

Used as an adjustable limit plug gage, the Holojust will check the bore diameter, as well as out-of-roundness and bell-mouth in any spot and any depth depending on the length of the handle. It will adjust accurately to any limits by means of micrometers or gage blocks. George Scherr Co., 200 Lafayette St., New York 12, or — **A1.**

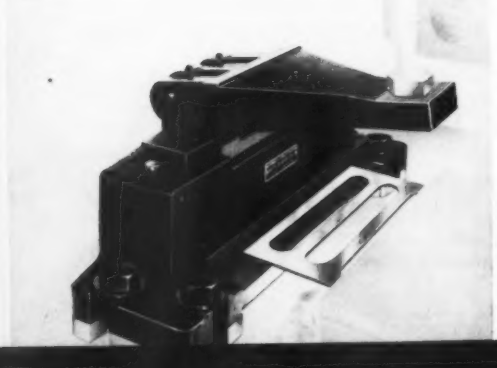
ABRASIVE TANK ON LAPPING MACHINE . . .

A detachable abrasive tank is featured on the Gyro-Matic "21" lapping machine, permitting precision flat lapping of work pieces on almost a non-stop production basis. The tank cuts machine maintenance and abrasive re-fill time. Spitfire Tool Co., 2931 N. Pulaski Rd., Chicago 41, or — **Circle No. A2.**



BAR FEED . . .

The Roto-Veyor automatic bar feed was developed for use with the Wells Model 1200 horizontal band saw. It has a manual control switch for fast, convenient job setup or stock removal. The capacity is 12¾" O.D. for rounds and 12" x 12" for rectangular shapes. Wells Mfg. Corp., 1940 Cedar St., Three Rivers, Mich., or — **No. A3.**



SCRAP CHOPPER . . .

Steel up to 12" wide and approximately 3/32" thick solid cross section is handled by the 12" scrap chopper. It fits any punch press and handles any coiled ribbon stock. Jaco Devices, Inc., 96 High St., Hingham, Mass., or — **Inform-A-Gram No. A4.**

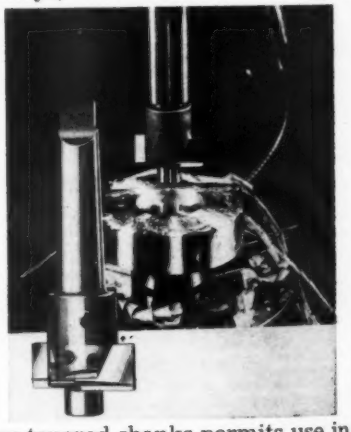
BEARING BUSHING . . .

A one-piece live bushing for piloting applications on horizontal boring mills has been announced by Donley Products, Inc., 11106 Avon Ave., Cleveland 5. It replaces the bronze bush-

ing in the outer support and increases accuracy by maintaining extremely close fit of bushing and bar without play or chatter. Each bearing bushing is made to individual boring mill specifications. **Circle Inform-A-Gram A5.**

ADJUSTABLE COUNTERBORE . . .

This tool will counterbore large diameters to precision tolerances and hold specific diameters even after numerous regrinds. It is used in spot-facing or counterboring steel forgings, heat treated steels, cast iron, titanium, stainless steel, aluminum alloys, etc. Choice of straight



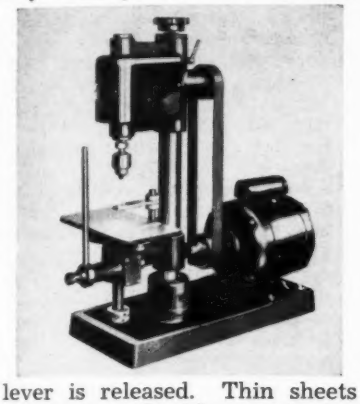
or tapered shanks permits use in radial drills, drill presses, turret lathes and milling machines. Five sizes are available covering hole sizes from 1" to 4" OD. Robert H. Clark Co., 9330 Santa Monica Blvd., Beverly Hills, Calif., or — **Circle No. A6.**

ON PARADE

Mail FREE Inform-A-Gram Card for MORE Details.

TAPPING MACHINE . . .

Many precision tapping operations are reduced to routine jobs by a small-hole tapping machine featuring a homing device which returns the spindle to neutral position instantly and automatically when pressure on the feed



lever is released. Thin sheets can be tapped without stripping and blind holes can be tapped to the bottom without tap breakage. The machine's capacity is 0.034″ x 120 to 0.25″ x 24. The Hamilton Tool Co., Hamilton, O., or — **Circle Inform-A-Gram No. A7.**

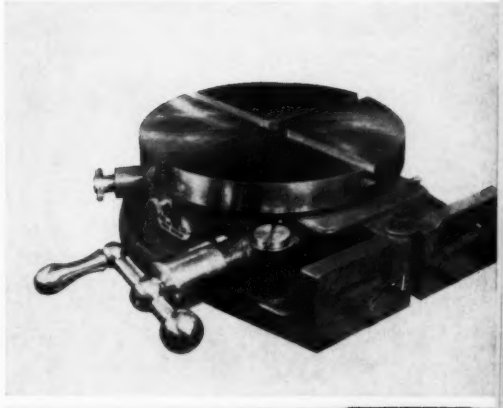
DRILL GRINDER . . .

Any combination of lip clearance and included angles can be set up in seconds on the Amiet 03-6 drill grinder. Two chucks cover the entire range from 0.012″ to 0.250″. Drill points are guaranteed concentric within 0.0005″. No resetting is neces-

sary for grinding different diameters or types of drills. The machine converts in seconds to handle left hand drills. Alina Corp., 401 Broadway, New York 13, or **Circle Inform-A-Gram No. A8.**

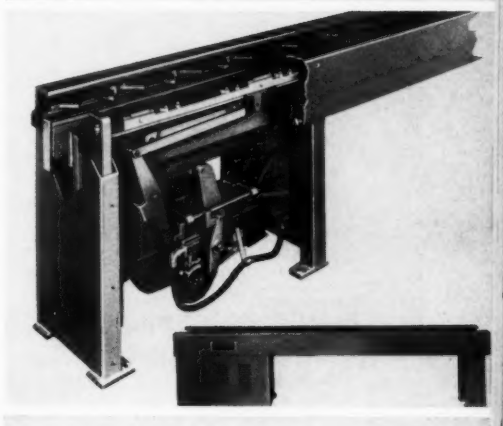
ROTARY TABLE . . .

This 12″ rotary table is designed for simplification of circular and rotary machining operations of all kinds. It features a base allowing both horizontal and vertical operation. Center hole run-out is guaranteed to be not more than 0.0005″. Universal Vise & Tool Co., Parma, Mich., or — **Circle No. A9.**



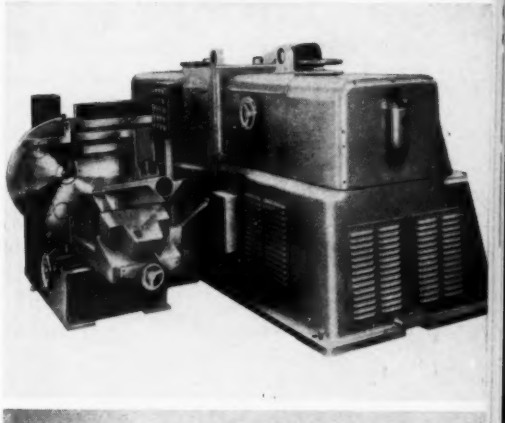
IN-LINE TRANSFER TABLE . . .

Transfer workpieces from station to station for automatic or manual operations with an in-line transfer table without fixtures. It can be adapted to multiple, consecutive operations, handling 6400 pcs/hr. Dixon Automatic Tool, Inc., 2300 — 23rd Ave., Rockford, Ill., or — **Inform-A-Gram No. A10.**



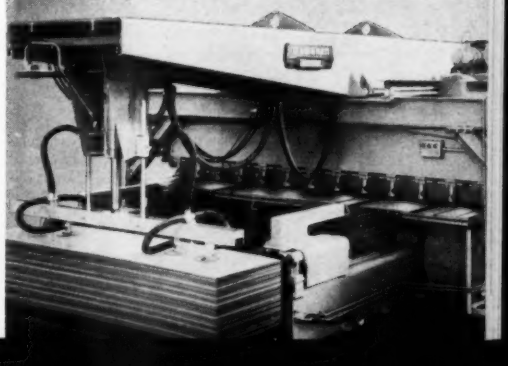
"PUSHBUTTON" GRINDING . . .

Reduce maintenance, dressing, changes and set-up down time using a new grinding machine with pushbutton controls on both sides. It is used for high speed precision finishing of piston and bearing rings, automatic transmission plates and similar shapes. The Besly-Welles Corp., S. Beloit, Ill., or — **Circle No. A11.**

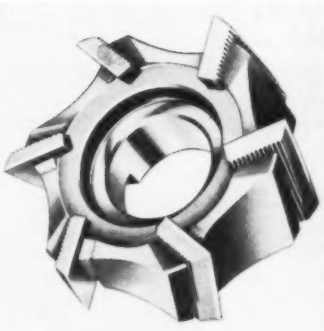


AUTO-SHEAR . . .

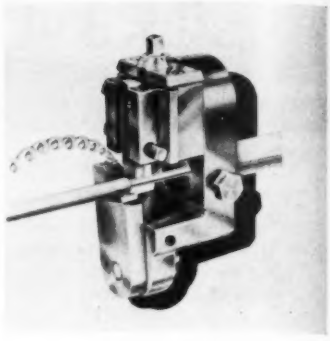
The Auto-Shear is a standard 1812 Series shear used with automatic handling equipment to form an automated sheared-blank production unit. Power source for the various material-handling components can be varied. For details, see Bulletin S-8 from The Cincinnati Shaper Co., Cincinnati 25, or — **A12.**



Machine Aluminum and light metal alloys with WND Series shell end mills. Diameters range from 3" to 8", overall widths from 1⅝" to 2", in either right hand or left hand cut. Details are found in Bulletin 35 supplied by Goddard and Goddard Co., 12280 Burt Rd., Detroit 23, or— **Circle No. A13.**



A Newly Designed Box Tool with built-in coolant tubes introduced by R. B. Tool Co., Inc., 785 N. Broadway, White Plains, N. Y., features micro-fine adjustment for the cutter that assures quick setup and adjustment of tool bits. Tool-holder can be used for left and right-hand turning. **Circle A14.**



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takes sick, worn out or damaged High Speed Grinder and Precision Boring SPINDLES and makes them NEW again . . . in HOURS . . . not weeks

Above is our Spindle Repair "doctor" checking the "heartbeat" of a rebuilt spindle with a stethoscope. He's listening for sounds of rubbing seals or any uneven tone at various speeds that might spell bearing trouble in the making.

This is an example of the care we regularly use to make certain the spindles we rebuild are returned to normal accuracy at all speeds.

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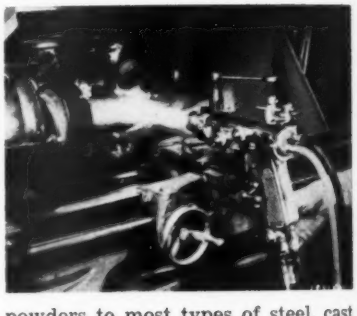
City_____ Zone_____ State_____

CIRCLE INFORM-A-GRAM KEY NO. 224

Two New Fibreglass-Reinforced Grinding Wheels have been introduced by Electro Refractories & Abrasives Corp., 344 Delaware Ave., Buffalo, N. Y. They are reported to have superior strength. One is a foundry cut-off wheel available in diameters up to 20". The other is a depressed center type wheel called a disc that comes in 7" and 9" dia. The cut-off wheel is used on steel alloys and non-ferrous castings. The depressed center reinforced wheel is designed for grinding normally hard-to-get-at spots with portable units. **Circle Inform-A-Gram No. A15.**

High Capacity and Efficiency are features of a new improved-design metal powder spray unit for applying hard-facing alloys and other metals in powder form. Model C-2 Spraywelder is used in applying the



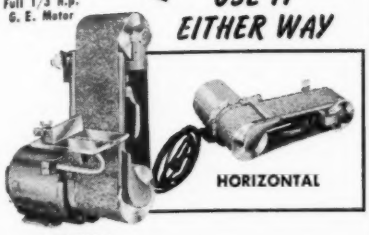
powders to most types of steel, cast iron and copper parts by the Sprayweld process. Wall Colmonoy Corp., 19345 John R St., Detroit 3, or — **Circle Inform-A-Gram No. A16.**

Speed Aluminum Fabrication with a low-cost ultrasonic soldering iron. It is capable of soldering aluminum without flux by completely removing all oxide film on the metal surface. Applications of Model E-7587-M include fabricating or altering aluminum patterns, electrical and electronic assembly work and filling blow hole defects in aluminum and light alloy castings. Acoustica Associates, Inc., Glenwood Landing, L. I., N. Y., or — **Circle Inform-A-Gram No. A17.**

WALLS TU-WAY BELT SANDER

USE IT EITHER WAY

Full 1/3 h.p. G. E. Motor



At last, a top quality industrial sander that provides all the most wanted features — yet sells for so little.

complete with cord, plug, switch ready to use **$89.95**

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WALLS SALES CORPORATION
333 Nassau Avenue Brooklyn 22, N. Y.

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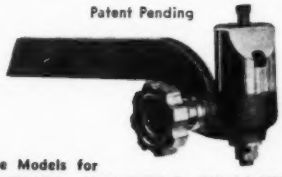
Monarch Precision
SHAPLANE
Radius Tools

Patent Pending



Five Models for
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RANGE ½" TO 3" RADIUS (MODELS ALSO AVAILABLE FOR CONVEX CUTTING, AND CONCAVE RADII TO 6" ON PLANERS, ETC.)

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Quality Tool Hardening Routine AT PITTSBURGH SCREW & BOLT CORP.

"The Sentry Diamond Block Atmosphere Makes the Difference"

Sentry DIAMOND Block

Pittsburgh's Sentry Furnace (shown below) hardens High Speed nut dies, pointing tools and High Carbon High Chrome trimming dies. Maintaining a constantly correct atmosphere, it "has eliminated decarburization, reduced grinding and finishing costs, increased life on dies and tools".

That's how the Sentry Diamond Block makes the difference . . . that's why Pittsburgh uses the Sentry Furnace for all quality tool hardening.

Sentry TRADEMARK **ELECTRIC FURNACES**

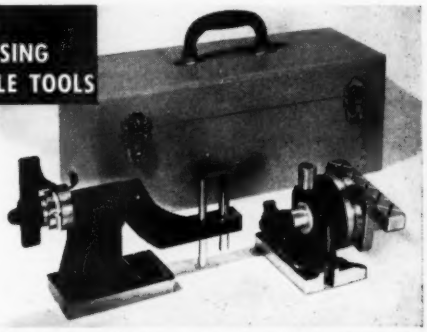
Request Catalog F-57 • *Write* **THE SENTRY CO., FOXBORO, MASS.**

CIRCLE INFORM-A-GRAM KEY NO. 2254

Now ANGLE TANGENT TO RADIUS WHEEL DRESSING WITH NEW VERSATILE TOOLS

MIGHTY GOOD AT ANY PRICE BUT TOPS AT ONLY $149.50
(Both tools including diamonds)

The G-5 RADIUS DRESSER is a precision engineered tool that will dress either a convex or a concave radius from .015" to 1.750" on a 7 inch or 10 inch wheel, and it may be set to the exact radii desired. Graduated stops allow you to dress any desired portion of a radius. The spring tension journal insures chatter free operation. The G-2 ANGLE DRESSER AND TOOL HOLDER is actually two tools in one, having an easy to read vernier scale 0° to 180° giving accuracy within 2" of 1°; an excellent time saver to set up small jobs to be milled, drilled, tapped, etc., on any desired angle.



Our fixtures will dress most radii and angles tangent to each other, similar to those shown below.

FREE handsome, wooden storage box. Write for complete information.

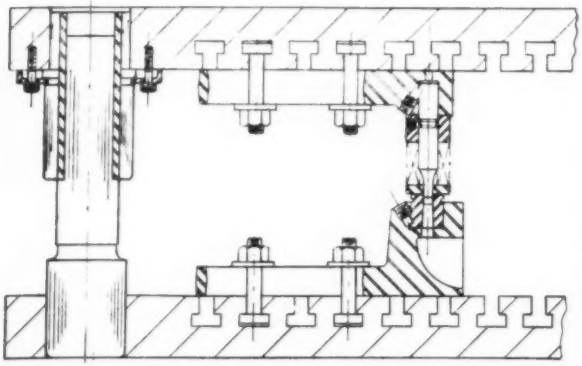
Distributorship available in select territories.

ROTHFUSS TOOL COMPANY
BOX 22, ELMWOOD STATION PROVIDENCE 7, R. I.

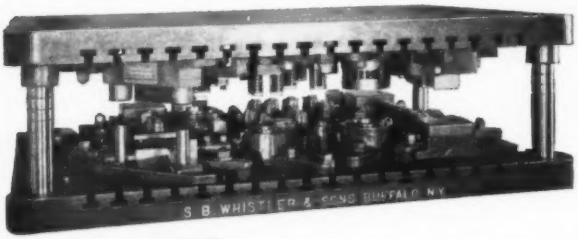
CIRCLE INFORM-A-GRAM KEY NO. 2255

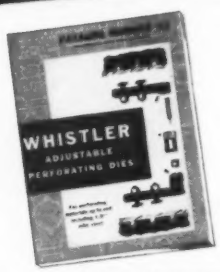
ADJUSTABLE DIES *by* WHISTLER

• Operate like a single purpose die • Easy to set-up and make changes • Interchangeable and re-usable parts always ready for a new job • Reduce die costs to a new low • Pierce holes in any desired arrangement of shapes and sizes • Precision piercing of materials to ¼" thick steel.



Above: Sectional drawing of a Whistler adjustable punch and die unit assembled in T-slot die set. **Below:** A completely assembled Whistler adjustable die ready for the press.





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to see for yourself in dollars and cents what this adjustable die making method can do for your plant. Send for it right now...without obligation.

S. B. WHISTLER & SONS, INC.
748 Military Road, Buffalo 23, N. Y.

ADJUSTABLE, MAGNETIC and CUSTOM DIES FOR ALL INDUSTRY
Direct Factory Representatives Located in Principal Industrial Areas

1957 — Our 40th Year Manufacturing Dies
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Rods Balls Screws Candies Nuts Discs Toy Parts Pins
Washers Die Cast Parts Bushings
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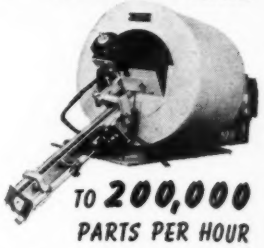

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All Bryant Surface Plates are manufactured from fine-grained *true quartz* granite. Their resistance to wear surpasses *all* other materials used as surface plates.

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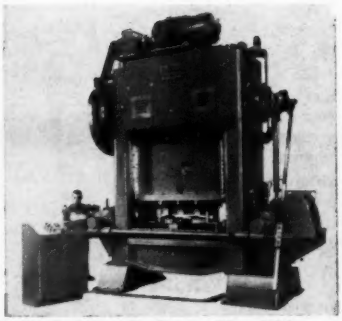
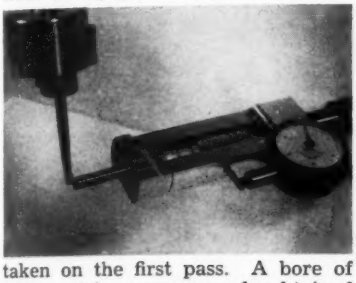
Fast Machining of Large, Complex Workpieces in one operation is performed by the 3AC single spindle chucking automatic for short and long production runs. Speed and feed changes are automatic. The Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, or — **Circle No. A18.**

Speeds Up To 250 Strokes/Min are a feature of the 200-ton high speed Flexopress. Equipped with air-friction type clutch and scrap cutter, the press has double feed rolls mounted integrally for accurate stock feed. Precision Welder & Flexopress Corp., 3520 Ibsen Ave., Cincinnati 9, or — **Circle Inform-A-Gram No. A22.**



This Tool Setting Gage produced by Euclid Instrument Co., 743 E. 232nd St., Euclid, O., is still gaining in popularity. When a tool is set with this gage, a finish cut can be



taken on the first pass. A bore of micrometric accuracy can be obtained every time. The gage saves time, eliminates shoulders in the mouth of the bore and increases production. **Circle Inform-A-Gram No. A19.**

Check Roll Dimensions with a complete gage now available from A. G. Davis Gage & Eng. Co., 21435 Dequindre, Dept. F 12, Hazel Park, Mich. The Roll-Chek gage provides a fast, positive method of checking difficult-to-gage roll dimensions. On countersink type flush pin gages these dimensions can be checked in less than 3 min. **Circle Inform-A-Gram No. A20.**

A New Industrial Air Drill has been announced by Superior Pneumatic & Mfg., Inc., 4758 Warner Rd., Cleveland 25. The S-P 1000 weighing 2 lbs, has a ¼" capacity, produces 2500 rpm and has ¼ hp at 90-

lb pressure. An exclusive patented metering trigger gives positive rpm control from 0 to 2500. It is ideal for automotive production, sheet metal work and similar work. **Circle Inform-A-Gram No. A21.**

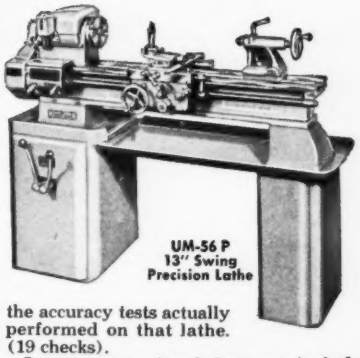
SHELDON Precision LATHES

for the size Lathes You Need Most

Sheldon lathes are built in the sizes you need most, for toolroom and production jobs. They are available with swings of 10", 11" and 13". . . in varying bed lengths with 18" to 48" center distances . . . and . . . in your choice of pedestal, cabinet or bench mountings.

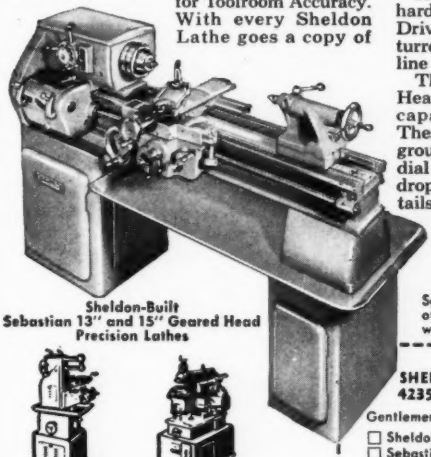
Powerful, all-V-belt, drive units—either the standard 8-speed (or 16-speed) E-drive; or the production favorite, a rapid, lever-shift U-drive. Where higher spindle speeds are desired, the standard E-drive can be built to provide speeds up to 2,000 r.p.m.

All Sheldon Lathes have handscraped, built-in precision. Each lathe is guaranteed to meet or surpass the American Standards for Toolroom Accuracy. With every Sheldon Lathe goes a copy of the accuracy tests actually performed on that lathe. (19 checks).



Important optional features include: hardened bed ways, L00 Long Taper Key Drive spindles, 4" D1 Camlock spindles, bed turrets, taper attachments and a complete line of toolroom and production accessories.

The new Sheldon-built Sebastian Geared Head Lathes have greatly increased work capacity and many advanced features. These include a wide, heavy, hardened and ground bed . . . easy shifting spindle speed dial . . . 60-pitch gear box . . . independent drop lever apron clutches . . . cam-action tailstock clamp . . . and, automatic lubrication in the headstock and apron with "1-shot" lubrication of carriage.



Sheldon-Built Sebastian 13" and 15" Geared Head Precision Lathes

SHELDON Horizontal Milling Machine

SHELDON 12" Shaper

SHELDON MACHINE CO., Inc.

Builders of Sheldon Lathes, Milling Machines, Shapers and Sebastian Lathes.

4235 N. Knox Avenue • Chicago 41, Ill.

Send in coupon or write for catalogs and names of nearest Sheldon and Sebastian Distributors where you can see these new lathes in operation.

SHELDON MACHINE CO., INC.
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Gentlemen: Please send new catalogs describing:

☐ Sheldon ☐ 10", ☐ 11' ☐ 13" Lathes
☐ Sebastian 13" and 15' Geared Head Lathes
☐ Horizontal Milling Machine ☐ Name of Local Dealer
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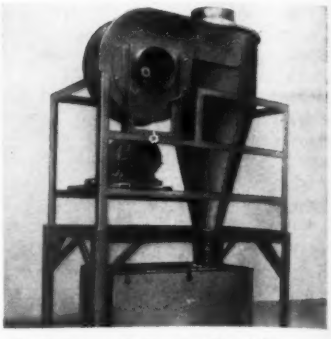
Name ..... Title .....
Company Name .....
Street Address ..... ☐ Company ☐ Home
City ..... State .....

CIRCLE INFORM-A-GRAM KEY NO. 227

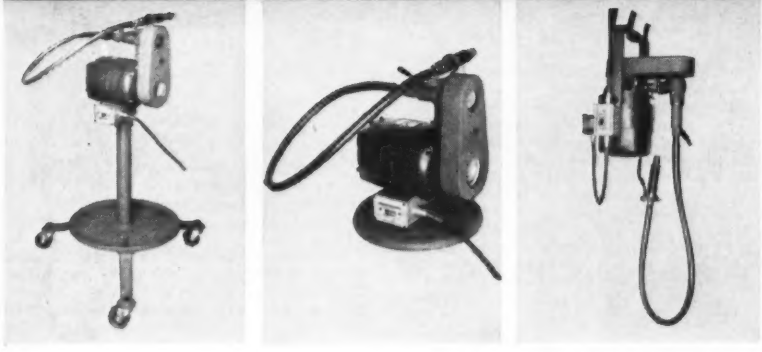
An Apprentice Tool Chest is now available from Brown & Sharpe Mfg. Co., Providence 1, R. I. It is equipped with 21 precision tools to meet the needs of the average apprentice in the metal-working trades. The chest has drawers of several depths and widths to accommodate any additional tools. **A23.**

A Storage Capacity of 37½ Cu Ft is a special feature of Model 90-NB-50 dust and mist collector. It is designed for use in operations where a large volume of dust, chips, shavings, etc., accumulate from manufacturing processes. Air handling capacity is approximately 10,000 cpm. Aget Mfg. Co., Adrian, Mich., or — **Circle Inform-A-Gram No. A24.**



R. G. haskins Co.

FLEXIBLE SHAFT MACHINES



faster Haskins machines will speed production on a big variety of metal-working jobs with their continuous speed and unerring performance. And there's no need to worry about changing tools—it takes just seconds to switch to any one of the numerous metal-working attachments in the Haskins line. *Use Haskins equipment and eliminate interruptions.*

easier Haskins flexible shaft machines make the whole operation a simple matter. They're portable—ready to go to work in whatever spot you choose, even remote sections of your plant. Operators say Haskins machines are easy to use because they have to hold only the lightweight handpiece which permits greater accuracy for close, precision work. You should know about Haskins flexible shaft machines and accessories-*leaders in their field for over 30 years.*

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605 S. Washtenaw Street Chicago 12, Illinois

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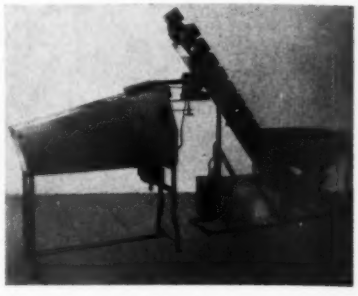
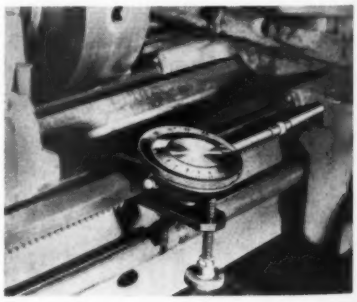
Gage Parts at Speeds Up to 200,000 Parts/Hr with a maximum error of ±0.0003" with the Precision Sorter. It will sort disc-shaped objects for thickness only, cylindrical parts for



diameter and headed items for head diameter only. The sorter combined with the Lift-O-Matic as shown, increases the range of products that can be gaged, sorted or graded. U. S. Engineering Co., 40-24 - 22nd St., Long Island City 1, N. Y., or — **Circle Inform-A-Gram No. A25.**

Accurately Measure the Carriage Travel of Lathes with a single setup with the Vernier Travel Gage. By means of 4" extensions, measurements can be made at greater lengths. The gage is ideal for use where close spacing or depth of cut



is required on lathes, milling machines and drill presses. It saves time in obtaining the proper position in layout and inspection work, in accurately gaging height or depth. Lloyd Tool Corp., P. O. Box 647, Burbank, Calif., or — **Circle Inform-A-Gram No. A26.**

NOW GET CLEAN SURFACED PARTS FROM YOUR AUTOMATICS ... UNMARRED BY TOOL WITHDRAWAL MARKS

THE NEW RELIEVOMATIC SELF-RELIEVING TOOL HOLDER

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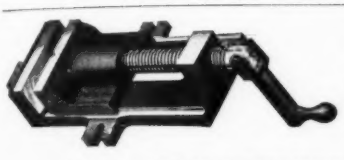


Cut Costs!

with the NEW YOST DRILL PRESS VISE

- Developed expressly for use on drill press operations.
- Does away with special and costly jig fixtures.
- Available in two sizes:

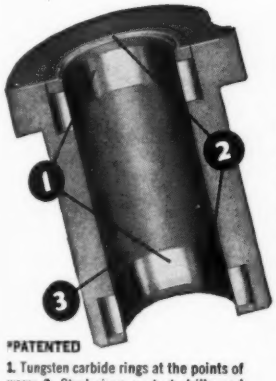
No.	Jaw Width	Max. Opening
1D	3½"	4 "
2D	5 "	5½"

Write today for bulletin on the extensive Yost line.

YOST MFG. CO. 124 Grant St., Cambridge Springs, Pa

CIRCLE INFORM-A-GRAM KEY NO. 2292

INCREASE PRODUCTION.. SAVE TIME & MONEY



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1. Tungsten carbide rings at the points of wear; 2. Steel rings protect drills and carbide; 3. Special hardened alloy steel body.

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Carbide Inserted Bushings Are Doing It Daily!

How? Like this: (1) Last longer . . . with a life—in most cases—as long as solid carbide bushings at prices that approach the price of steel bushings; (2) Increased life for your drill jigs and fixtures; (3) Increased life for your drills and reamers; (4) Accuracy maintained for a LONG PERIOD of time; (5) Less non-productive machine time, less lost man-hours, because bushings need not be changed as often; (6) Inspection time saved, because of greater accuracy for a longer time; and (7) Less waste due to spoilage, for the same reason. Don't pass up a good bet! Get the dope on MEYCO Carbide Inserted Drill Jig Bushings today!

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W. F. MEYERS CO., INC., BEDFORD, INDIANA

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ACCURACY .0002 T.I.R.

.0002 T.I.R. OR LESS AT SPINDLE NOSE, .0005 T.I.R. OR LESS ON TEST ARBOR SIX INCHES FROM SPINDLE NOSE

SPINDLE SPEEDS 150 and 250 RPM Other Spindle Speed Pulleys Available

MODEL B943 MOTOR DRIVEN WORK HEAD

No. 11 B & S Tapered Spindle Standard Equipment. No. 12 B & S or No. 5 Morse Available at Slight Extra Cost. Same Accuracy Guaranteed!

The B943 Motor Driven Work Head is a compact self-contained power unit for internal and external grinding. It is held in position by two T-slot bolts and can be mounted at any convenient spot on the table. The swivel base, which is graduated 90° one side of center and 45° on the other, permits the Work Head to swivel full 360° if desired. Swivel base can be easily removed from head permitting units to be mounted on table without base if desired. The B943 is easily and quickly mounted on other makes of grinders.

The No. 11 B & S tapered spindle, mounted on ball bearings, is hardened and ground, and is designed to receive chucks, collet fixtures, face plates, straight or tapered sleeves, centers and like equipment. Unit is grease packed at factory and requires no service in the field for the life of the bearings. Streamlined in design, this fixture is quickly mounted and is easy for the operator to keep clean.

The special motor is provided with conveniently located reversing switch which is handy for the operator regardless of the position of the work table or rotation of the work. Motor operates quietly and is fully protected from dust and from any oil entering from working parts.

See this extremely accurate B943 work head at your equipment dealer or write for complete literature.

K. O. LEE COMPANY

ABERDEEN, SOUTH DAKOTA

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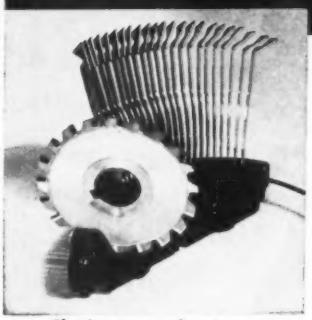
SAW IT with a GAY-LEE

"THINSAW"



Slotting typewriter type bar segment.

Solve problems in high-precision slitting, slotting, sawing with Gay-Lee carbide-tipped Thinsaw! Wafer-thin for the most delicate work with positive alignment and rigidity that avoid run-out . . . but retaining the speed and long life of carbide. Patented construction holds tips firmly.

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Stronger Braze Circular Seat

- THIN AS .030"
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Complete Line of Saws for Any Application—To Any Tolerance

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GAY-LEE COMPANY
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JOMI TORQUE WRENCH

IMPROVES YOUR PRODUCT'S QUALITY...SAVES YOU TIME AND MONEY...

- JUST SET YOUR TORQUE — Jomi automatically cuts out at the exact tension needed!
- SOCKET WRENCH SIMPLICITY — precision torque limitation depends on wrench, not operator. Easy to use ...no dials or gauges to read!
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▶ for torque requirements from 10 inch-ounces to 2000 foot-pounds

▶ designed to meet specifications MIL-H-4034A (USAF)

Write today for your free JOMI catalog with valuable Torque Table Data.

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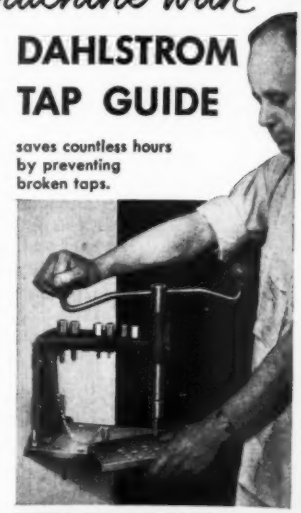
CIRCLE INFORM-A-GRAM KEY NO. 2302

Precision Tapping

by hand or machine with

DAHLSTROM TAP GUIDE

saves countless hours by preventing broken taps.



A low-cost Dahlstrom Tap Guide provides the accuracy and close tolerances of larger machines costing many times as much. Tap breakage, a major expense in many shops, is virtually eliminated with a Dahlstrom Tap Guide because metal material is always held straight and square. Light enough for portability, yet it can be bolted to wall or post for permanent installation.

Machine Tapping

The spindle top is centerbored to fit the tail stock of a lathe. Simply pull out for lathe use. The same spindle can also be used as a tap extension for reaching hard-to-get-at places. Tap Guide is furnished with nine adaptor sizes: 8-32; 10-24; 1/4", 5/16", 3/8", 7/16", 1/2", 5/8", and 3/4". *Write for bulletin.*

$59.50 F. O. B. Factory

BRANCH MFG. CO.
16 Olson Drive, North Branch, Minn.

CIRCLE INFORM-A-GRAM KEY NO. 2303

D-R SMALL LOT STAMPING FROM TEMPORARY TOOLS

SOLVES A TOUGH COST PROBLEM

Converting from a casting to a sheet steel stamping reduced this customer's cost to one-tenth his old method.

Only 200 piece parts/year were needed, and an annual design change was a further possibility.

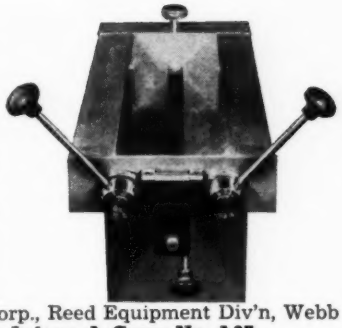
Dayton Rogers produced 100 pieces for less than the cost of the tool steel used in making a conventional die for such a part, *with superior results.*

GOT A DESIGN-ENGINEERING PROBLEM? SEND YOUR SKETCH, BLUEPRINT OR PART, PLUS QUANTITY, FOR PROMPT QUOTATION

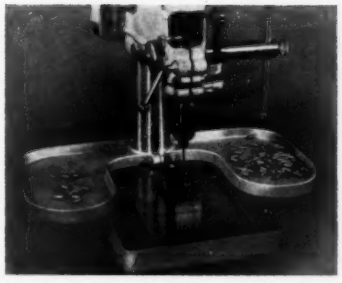
DAYTON ROGERS Manufacturing Company

MINNEAPOLIS 7B, MINNESOTA

CIRCLE INFORM-A-GRAM KEY NO. 2304

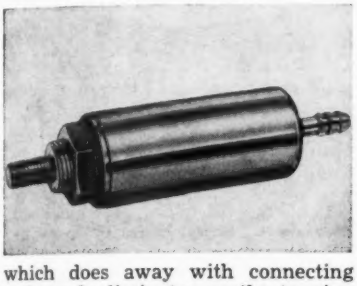


Weld Longitudinal Seams on various cylinders and flat sheets with new Series B longitudinal seam welders. They can be used manually or fully automatic on experimental, short run and production work, handling parts as small as 3" dia and as large as 30" dia. The Webb Corp., Reed Equipment Div'n, Webb City, Mo., or — **Circle Inform-A-Gram No. A27.**



Designed to Aid Drill Press Operators in regular job shop work and to reduce needless motion in production line drill press operation is T-10 drill press utility tray. It is used to hold drills, wrenches, etc. and component parts. Fits all standard 2", 2¾" and 3½" drill press columns. The Patton Mfg. Co., Inc., Small Products Div'n, 1802 W. Pleasant St., Springfield, O., or — **Circle Inform-A-Gram No. A31.**

Clamp, Press, Eject or Hold Small Pieces with a non-repair air cylinder. It can also be used to open and close jigs or fixtures. Model 091 features a low-cost method of construction



which does away with connecting rods and eliminates costly tapping operations. At 100 psi it will exert a force of 90 lbs for a 1" stroke. Bimba Hardware & Mfg. Co., 101 Main St., Monee, Ill., or — **Circle Inform-A-Gram No. A28.**

Two New Fire-Resistant Hydrolube Fluids are now available from Carbide and Carbon Chemicals Co., Div'n of Union Carbide and Carbon Corp., 30 E. 42nd St., New York 17. Ucon hydrolubes 150-CP and 275-CP have outstanding corrosion and wear resistance. They are widely used in applications where petroleum oils would present a fire hazard. **Circle Inform-A-Gram No. A29.**

Form and Finish a variety of materials with a new planing cutter file. The Phoenix file can be used effectively on brass, bronze, cast iron, steel, Plexiglas, rubber, and Bakelite. Chips drop through the file slots

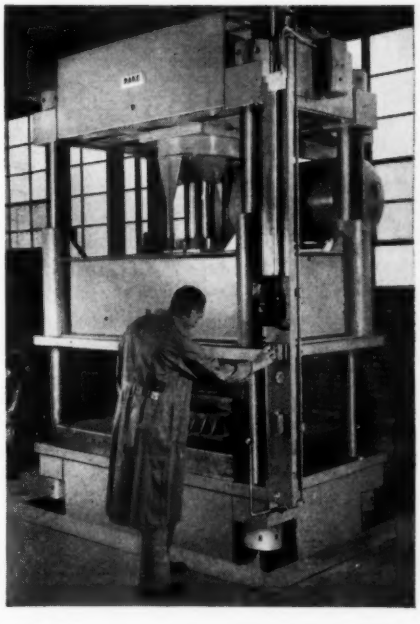
without clogging, eliminating the need for cleaning the file blade. John A. Bailey, Associates, 1026 Forbes St., E. Hartford, Conn., or — **Circle Inform-A-Gram No. A30.**

PROBLEM

to produce low-cost prototypes of a new design without the high cost of permanent tooling

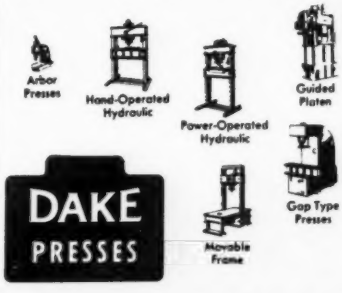
SOLUTION

a single 300-ton Dake Hydraulic Die Tryout Press with temporary tooling



Die tryout is a key operation for most die jobbing shops. This is the test that either proves or rejects a die before it is placed in production. But a lack of adequate press facilities is usually the big drawback. A well-known Chicago diemaker, Cripps Engineering and Tool Co., Inc., has effectively solved the problem of die tryout. Although they had a number of production presses, there was a need for greater die tryout capacity. Now with a single 300-ton Dake Hydraulic Press, this diemaker is able to test all dies before delivery to the customer. The result: shop down time is held to a minimum and production efficiency runs smoothly without interruption. Specifications for single-acting and double-acting die tryout presses in eighteen electrically operated models are contained in Bulletin 330. Write today for your copy.

DAKE CORPORATION, 634 Seventh St., Grand Haven, Mich.



SEND TODAY FOR BULLETIN 330

DAKE CORPORATION
634 Seventh St., Grand Haven, Mich.

Please send me a copy of Dake Bulletin 330.

Name_____

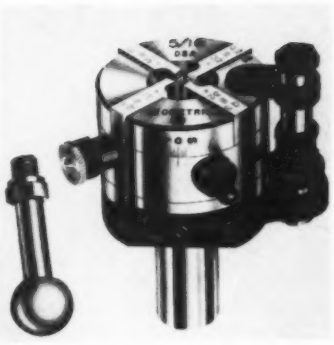
Company_____

Address_____

City_____ Zone____ State____

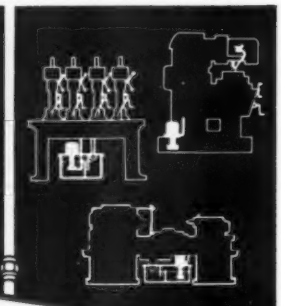
CIRCLE INFORM-A-GRAM KEY NO. 231

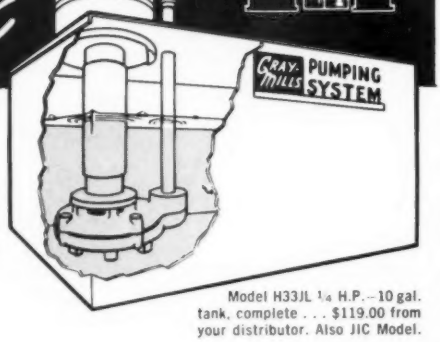
A Convertible Self-Opening Die Head has been introduced by Geometric Tool Co. Div'n, Greenfield Tap and Die Corp., New Haven 15, Conn. Model DSA is designed for use on Brown and Sharpe and other small screw machines of automatic or hand type. **Circle A32.**



An Improved 2-Ton Punch Press features the same type of heavy-duty clutch as the Benchmaster 8- and 5-ton models. It features a sliding-key-type clutch dog which removes the driving load from the crankshaft keyway. Benchmaster Mfg. Co., 1835 W. Rosecrans, Gardena, Calif., or — **A33.**

put a GRAYMILLS COOLANT PUMP on that machine and Relax





1. They're Dependable—Superflo models require no service
2. Abrasive Proof—No bearings, seals or packings to wear
3. Abundant Volume—of coolant or oil, year after year
4. Standard NEMA Motors—extra power for peak loads

Model H33JL ¼ H.P.—10 gal. tank, complete . . . $119.00 from your distributor. Also JIC Model.

Yes, you'll get smooth, steady performance, *at less cost*, with Graymills pumps or units for original equipment, replacement or conversion. That's why more and more machine tool builders are using Graymills. You'll like the personal services too, they are sold by leading Industrial Distributors and Graymills representatives near you are ready to help with special problems. Specify "GM" pumps—install 'em—forget 'em—relax!

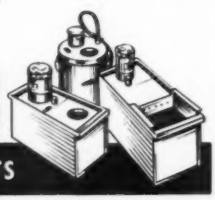
Graymills Corporation, 3713 N. Lincoln Ave., Chicago 13, Ill.

141

WRITE FOR THIS NEW CATALOG

showing standard and JIC model centrifugal and gear type 1/25 to ¾ H.P. Pumps, Pumping Units, Accessories and helpful selection chart.

GRAYMILLS

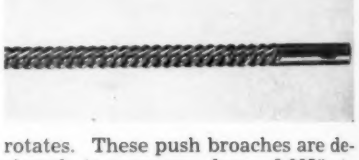


Superflo COOLANT PUMPS AND UNITS

CIRCLE INFORM-A-GRAM KEY NO. 232

A Portable Power Screwdriver with Automatic Self-Feed has been developed for mass assembly operations by Illinois Tool Works, Shakeproof Div'n, St. Charles Rd., Elgin, Ill. The Semspak tool drives screws automatically at any angle as fast as the operator can pull the trigger. It will accommodate screws with a 7/16" minimum and a 1½" maximum length and either round, pan, oval, flat, Fillister, hexagon, slotted or Phillips heads.
Circle Inform-A-Gram No. A34.

Produce Perfect Holes at Low Cost with standardized dual purpose push broaches. They can be used as conventional push broaches in punch and hydraulic presses, and turret and regular lathes. In addition, they can be used as rotary broaches in machines in which the part or tool



rotates. These push broaches are designed to remove from 0.005" to 0.015" of stock in the hole finishing operation. They provide an extremely fast method of finishing holes to exact size through a shearcutting action. Shearcut Tool Co., 7045 Darby Ave., Reseda, Calif., or —
Circle Inform-A-Gram No. A35.

Automatic Filtration, regulation and lubrication of air supply to pneumatically operated equipment is provided by a line of combination units. These filter-regulator-lubricators are available in ¼", ⅜" and ½" sizes. The filter features a contoured air passage which gives the incoming air a downward spiral motion. The regulator provides instant regulation of the reduced pressure for sudden, heavy and/or widely varying flow demands. The lubricator assures almost complete vaporization and assimilation of the metered oil. Watts Regulator Co., Lawrence, Mass., or —
Circle Inform-A-Gram No. A36.

CONTRACT TOOLING AND PRODUCTION

Illinois

DRESEL-BETZ CO.
Belleville, Ill.
Designers and Manufacturers of Tools, Dies, Jigs, Fixtures, Metal Stampings,

Michigan

DAVIS TOOL and ENGINEERING CO.
19250 Plymouth Road, Detroit, Michigan, VErmont 5-6000. Tools and Dies, Special Machinery, Sheet Metal Stampings and Assemblies.

Ohio

CLEVELAND UNIVERSAL JIG COMPANY
13404 St. Clair Ave., Cleveland, Ohio. MU 1-2600
DESIGNERS AND BUILDERS
Jigs and Fixtures Special Machines
Production Engineering
Complete Plant Routing and Tooling

GENERAL DIE & TOOL CO.
2067 W. 55th St., Cleveland, Ohio
WO 1-4736
Dies, Tools, Jigs, Fixtures, Light Stampings, Special Machinery Manufacturing.

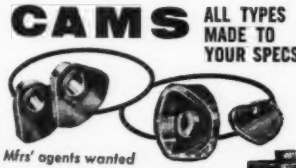
THE INDUSTRIAL MACHINE CO.
1436 East 47th St., Cleveland, Ohio. Founded in 1908. Builders of Special Machinery. General Machine Work.

KIFFER TOOL & DIE CO.
5601 Tillman Avenue, Cleveland, Ohio, WOodbine 1-2440 & 1-2441. Manufacturers of Special Machinery, Tools, Dies, Jigs, Fixtures, Swiss Jig Boring.

NOBLE & STANTON, INC.
998 Broadway, Bedford, Ohio, Bedford 2-2800. Tooling, Short Run Production and Machined Parts for Automation.

A. P. SCHRANER & CO.
3338 Payne Ave., Cleveland, O., HEnderson 1-8644. External Cylindrical Lapping Machines. Special Machinery, Tools, Dies, Jigs, Fixtures.

CAMS ALL TYPES MADE TO YOUR SPECS



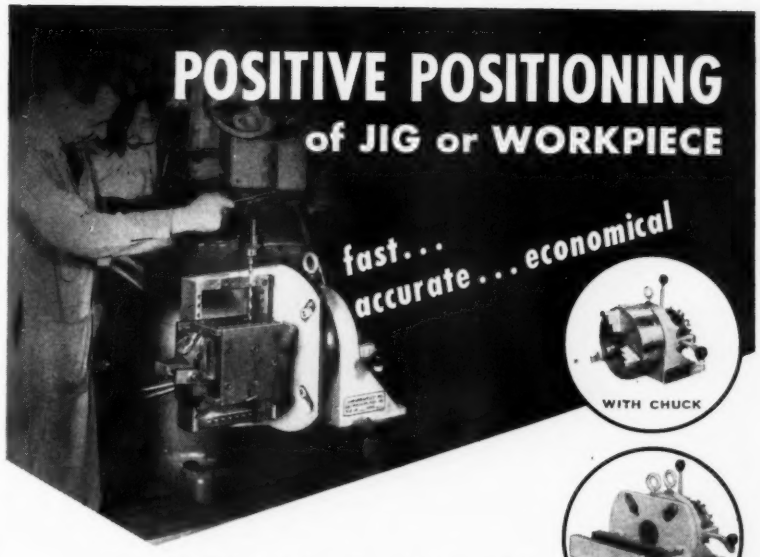
Mfrs' agents wanted

Dr. Chas. Eisler ME, Founder
Chas. Eisler, Jr., Pres.

EISLER ENGINEERING CO., INC.
732 SO. 13TH ST., NEWARK 3, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 2331

POSITIVE POSITIONING of JIG or WORKPIECE



This J&B Indexing Trunnion, complete with built in station selector, will increase production speed and accuracy on your drilling, tapping, or counterboring operations.

- Reduces set-up time.
- Simplifies jig construction.
- Jig rotation removes chips.
- Eliminates abuse to machine table.
- Positive indexing by 15° increments on 0 - 360° graduated dial.
- Mounts on your present T-slotted tables.
- Compact, rigid, and accurate.

AVAILABLE SIZES 7", 10", 14", 18", 24"

Ask for Bulletin IT 7

EST. J&B 1870

JOHNSON & BASSETT, INC.
PRODUCTION TOOL DIVISION
WORCESTER, MASSACHUSETTS

CIRCLE INFORM-A-GRAM KEY NO. 2332

Empire
LIVE CENTERS
ARE
• ACCURATE • VERSATILE
• HEAVY DUTY

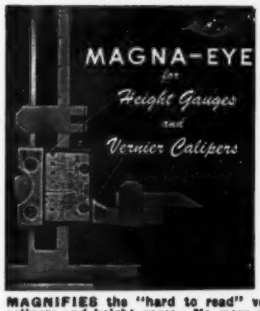
Manufactured in all tapers. 1 to 6 MT in stock. Special shanks and points made to order. PAT. PEND.

Points illustrated are standard.

Ask your Supplier or Write for Literature

ROYAL PRODUCTS
88 UNION ST. MINEOLA, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 2333



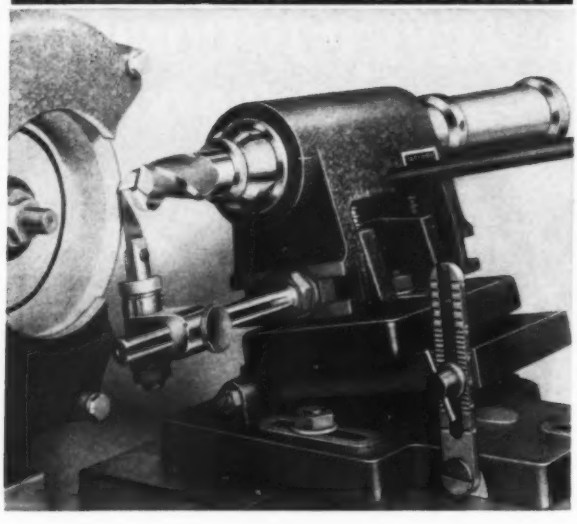
MAGNIFIES "HARD-TO-READ" VERNIER SCALES ON HEIGHT GAGES AND CALIPERS

MAGNIFIES the "hard to read" vernier scales on calipers and height gages. No more eye strain, guess work or hit or miss setting and reading. LENS is finest quality optical glass, specially designed and ground for the purpose with utmost optical skill. 4X magnification shows lines true and correct. In daily use in plants of Westinghouse, General Electric, General Motors, Chrysler, Packard, Ford, Boeing Aircraft, Bendix Aviation and many others engaged in defense work.
Made in 3 sizes to fit Starrett, Brown & Sharpe, Lufkin Tools, and others of similar design. S No. 100 for 6" Vernier Calipers; S No. 200 for 10"-12" Height Gages, also 10"-18"-24" Vernier Calipers; S No. 300 for most popular type 18" and 24" Height Gages and for 36"-48" 60" and 72" Calipers.
For Complete Information Write, Phone or Wire

STEBAR COMPANY
215-221 28th Ave. North Minneapolis 11, Minn.

CIRCLE INFORM-A-GRAM KEY NO. 2334

YESTERDAY'S PIONEER • • • TODAY'S LEADER



WELDON
End Mill Sharpening Fixture

• The Weldon Sharpening Fixture quickly resharpens end mills from 1/16" to 2" inclusive. Unnecessary to line up the fixture as it will always grind straight. Designed for any grinder with flat table. No table movement necessary.

Requires little skill to operate. Increases life of end mills and improves their performance.

Write for Circular

Weldon distributors throughout U. S. A. and Canada carry complete stocks to serve you.

THE WELDON TOOL COMPANY

3000 WOODHILL ROAD • • • CLEVELAND 4, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 2341

After consultation with our engineering staff and with the use of dies from our tremendous library maintained specifically to save our customers time and money, this part illustrated actually saved one manufacturer 94% of usual production costs!

Price breakdown was as follows:

Tools	$89.00
Labor	.072
Material	.011

LOW die cost
FAST delivery

- Blanking
- Forming
- Piercing
- Drawing
- Extruding
- Stenciling
- Tapping
- Countersinking
- Plating
- Machining
- Painting
- Grinding
- Welding

Yes, WLS SPEEDTOOLING for small quantity stamping needs is a saver every time! A radical production advancement, it eliminates most of the cost required for permanent dies. Finished parts are produced to tolerances as close as those from tools costing ten times as much. When jobs are completed WLS SPEEDTOOLING is stored for future use.

Use WLS for production quantities up to 100,000 when low cost, fast delivery, possible design changes for virtually nothing, are important factors!

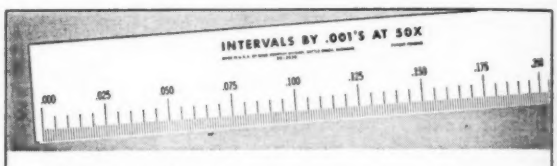
FREE

1. Write now for a free sample part with a cost summary.
2. Our free bulletin also illustrates 40 small stampings.
3. Send in your blueprints to our engineering department for a prompt quotation.

WLS **STAMPING COMPANY**

3283 E. 80th Street • Cleveland 4, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 2342



Gage Company **PRECISION PLASTIC**
COMPARATOR SCALES

Non-breakable...accurate...designed for making quick measurements at scale on projectors and comparators without any movement of machine or work.

An unexcelled tool for use in drafting and constructing scale layouts for comparator chart use. All standard magnifications and various styles for every application.

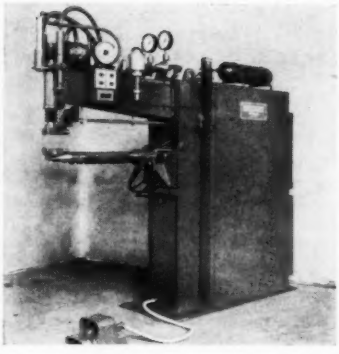
WRITE FOR BULLETIN NO. 54-1511

GAGE COMPANY

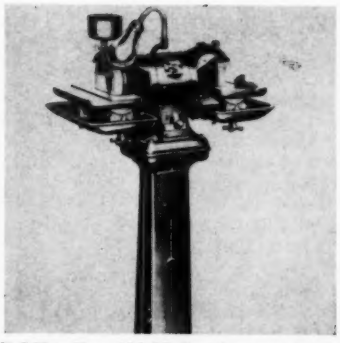
BATTLE CREEK, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 2343

A Seam and Spot Welder for very light gauge metals has been announced by Sciaky Bros., Inc., 4915 W. 67th St., Chicago. The low inertia pressure system of Model PMM-OC-50-36 provides maximum strength with minimum friction. This air-operated electric resistance welder has a throat depth of 36". **Circle A37.**

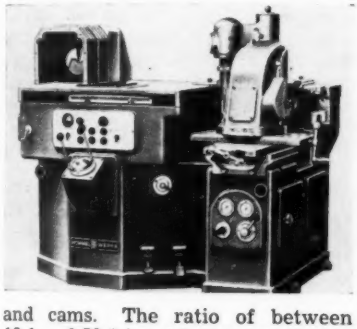


This 6" Carbide Tool Grinder offers time and cost savings for any shop using carbide-tipped cutting tools. Tables tilt 30° in and 45° out to permit wet or dry grinding at any angle. The aluminum wheel flanges are drilled for mounting either silicon carbide or diamond wheels. Walker-Turner Div'n, Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, or — **Circle Inform-A-Gram No. A41.**



Increase Tool Life Up To 35% with a new coolant for heavy machining operations. International Tooleze 1234 has exceptional wetting properties that provide maximum cooling efficiency and permit faster and heavier cuts. It prevents the welding of chips to the cutting tool while acting as an effective rust preventive. International Chemical Co., 2628 N. Mascher St., Dept. 312, Philadelphia 33, or —**Inform-A-Gram No. A38.**

Grind Many Types of Profile Tools, workpieces and gages with the Hommel OPSM optical profile grinder. It can also be used to check the profile on gages, circular and straight form tools, press tool punches, and dies



and cams. The ratio of between 10:1 and 50:1 is set by means of gage blocks, ensuring high precision. Aaron Machinery Co., Inc., 45 Crosby St., New York 12, or — **Circle Inform-A-Gram No. A39.**

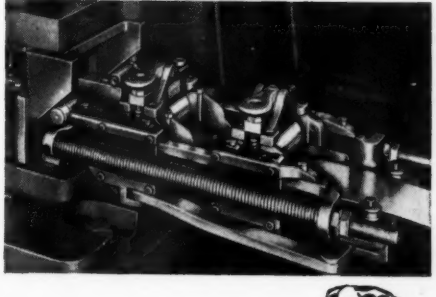
Save Time and Money on Inspections with a low-cost Stereo Microscope. It provides up to 3" working distance, giving an erect, clear sharp image, correct as to right and left. It is used for inspections, counting, checking, assembling and for speeding and improving quality control. Two sets of objectives are on a rotating turret. A standard pair of wide field 8X Kellner eyepieces give 21 power and 34 power. Edmund Scientific Co., Barrington 17, N. J., or — **Circle Inform-A-Gram No. A40.**

THE BOSS... gains through automation—overall production economy that means more work per day, per dollar.

8 ways to benefit... save... with

Dickerman FEEDS

PRESS ROOM FOREMAN... benefits by speed—Dickerman feeds operate continuously at any speed the tooling in the press will withstand.



PRESS OPERATOR... welcomes simplified operation—Dickerman feeds prevent human fatigue, human error, work indefinitely without downtime.

QUALITY CONTROL MEN... cheer the constant accuracy and uniformity Dickerman feeds bring to any press feeding job.

ASSEMBLY FOREMAN... gains as components flow in steadily—there's never an afternoon letdown, never a production lag.

THE CUSTOMER... is always ahead because deliveries are always on time, always "as specified".

DIE DESIGNERS praise the Dickerman templates that help them engineer Dickerman feeds onto their presses—send for your copies today!

You'll benefit through increased production . . . greater accuracy . . . bigger profits when you install dependable Dickerman Die Feeds, Hitch Feeds®, and Rol-Di-Feeds on your presses.

Dickerman

H. E. DICKERMAN MFG. CO.

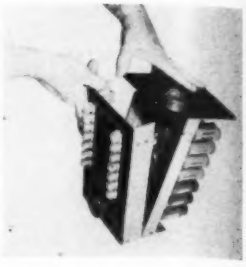
321-302 Albany Street, Springfield, Mass.

Send today for complete details on the money-making Dickerman line.

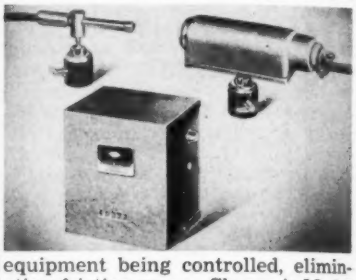
CIRCLE INFORM-A-GRAM KEY NO. 235

Increase Efficiency of Assembly Operations with Nes-Tier Model M parts hoppers. The units are mounted side-by-side and in various heights on a rack making small parts conveniently available to assemblers. The Chas. Wm. Doepke Mfg. Co., Inc., 8911 Blue Ash Rd., Rossmoyne, O., or—**A42.**

Ultra-Compactness is a feature of the package controls announced by Sensory Inc., 504-255 Pleasantville Rd., New Vernon, N. J. These Director Systems direct machines to perform various sequences of simultaneous functions to form complete cycles of operation. They are available for fully automatic control of many types of machine tools and manufacturing operations. **Inform-A-Gram No. A43.**



Miniaturization of Components is featured in low-cost photoelectric controls. Counting, inspection, machinery safeguards, actuation and other functions are performed without contact with the material of the



equipment being controlled, eliminating friction wear. Shown is Model REC3 Robot-Eye control. Standard Instrument Corp., Robot-Eye Photo Control Div'n, 657 Broadway, New York 12, or — **Inform-A-Gram A44.**

Inspect Blocks to an accuracy within several millionths of an inch with the Accutron gage block comparator. It will accommodate blocks up to 4" long. The instrument has extra rigid construction of base and gage head for supporting the bracket. Super-fine vertical adjustment located in the base provides fine adjustment of gage head to work. The Sheffield Corp., Dayton 1, O., or — **Circle Inform-A-Gram No. A45.**

A Permanent or Portable Coolant Supply for all small and medium size machine tools is provided by Model 505-T coolant pump and tank. Weighing 27 lbs, the self-contained unit can

pump from 1 to 500 gal/min of light oil or soluble compounds to work. Heavier oils and compounds can be used also at lower gallonage. The Brady Pump Corp., Muncie, Ind., or **Circle Inform-A-Gram No. A46.**

Lapping and Electrolizing Make Taft-Peirce Gages Wear Many Times Longer!

Exclusive T-P Pilot

Here's another T-P Plus feature! The Taft-Peirce Pilot reduces inspection costs . . . radius and groove on end of gage member prevents chipping and burring, prolongs gage life. Available on single or double end plug gages.

Your money goes a long, long way when you order T-P Electrolized Gages! The combination of lapping plus electrolizing means that every gage will stay accurate, longer. Precision lapping produces an *exact*-sized gage — no "hills" and "valleys" to wear rapidly and destroy gage accuracy. Electrolizing puts an even film of hard, non-magnetic alloy on all gaging surfaces to give exceptional wear resistance. Initially costing only slightly more than ordinary hardened steel gages, Taft-Peirce Electrolized Gages more than pay for the difference in longer gage life. Result: Your budget for gages goes much farther, and your inspectors work with the best accuracy you can buy. For more information, call or write: The Taft-Peirce Manufacturing Co., Woonsocket, R. I.

The Taft-Peirce Family

Air Gages	Tool-Room Specialties
Magnetic Chucks	Grinding Machines
Precision Gages	Lapping Machines

TAKE IT TO TAFT-PEIRCE

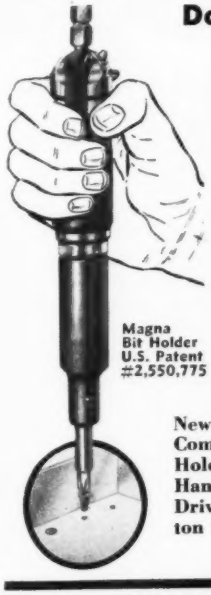
THE TAFT-PEIRCE MANUFACTURING COMPANY
WOONSOCKET, RHODE ISLAND

T-P Means TOP Precision

FOR DRIVING RECESSED HEAD SCREWS

MAGNA BIT HOLDERS

Do it quicker, cheaper



Magna Bit Holder U.S. Patent #2,550,775

Hundreds of leading manufacturers specify Magna-Tip (magnetic) screw holding accessories for their power screw-drivers to push production up, costs down. Here's how Magna-Tip Bit Holders can work for you:

1. **Eliminate prepositioning screw**
2. **Allow faster driving in tight spots**
3. **Prevent screws from dropping**
4. **Eliminate screw head burring**
5. **Increase bit life by reduced slippage**
6. **Safer...operator doesn't hold screw**

Ask your power screw-driver salesman to show you these handy Magna accessories.

New Manual ready; write Dept. 88-H Complete information on Magna Bit Holders, Finders, Sockets and Hand Screw-drivers. Magna Driver Corp., 779 Washington Street, Buffalo 3, N. Y.

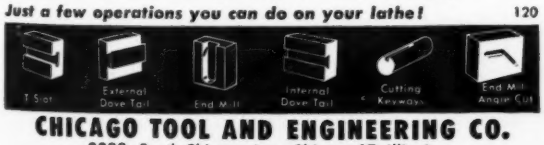
CIRCLE INFORM-A-GRAM KEY NO. 2371

NOW...you can CONVERT LATHES FOR MILLING in 10 seconds with the PALMGREN MILLING ATTACHMENT

No. 250

Now, in your own shop, on your present lathes, you can do such jobs as Milling, Slotting, Grinding, Grooving, Sawing at angles, recessing and many more complicated jobs easily and quickly with the Palmgren Milling Attachment. Yes, in just 10 seconds you can convert to any of these operations and save time and money doing work you formerly had to send out. Precision built, graduated for rotary angle and vertical adjustments, easily mounted on all makes of lathes by straddling tool post, this attachment has proved highly valuable in thousands of shops, both large and small. Three sizes: jaw widths 1½" $18.75; 2½" $24.75; 4" $39.75. Available NOW! Get more out of your lathes by using these versatile Palmgren Milling attachments. Write today.

Just a few operations you can do on your lathe! 120

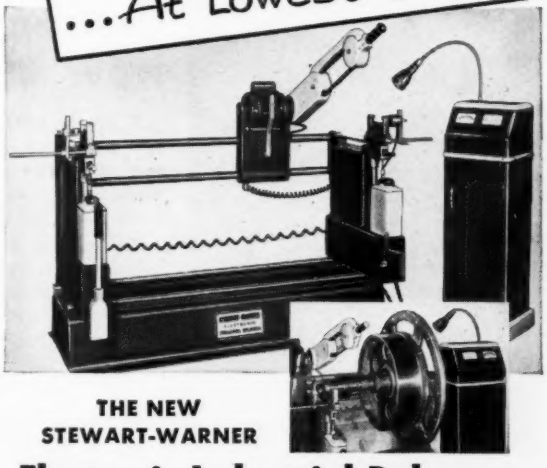


CHICAGO TOOL AND ENGINEERING CO.
8388 South Chicago Ave., Chicago 17, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 2372

NOW! the most versatile, precision DYNAMIC BALANCERS

...At Lowest Cost!



THE NEW STEWART-WARNER

Electronic Industrial Balancers

- ★ **3 models for use in single-piece, short-run or long-run production quantities.**
- ★ **Set-up time less than 2 minutes!**
- ★ **For balancing a wide range of work on same machine—with no special tooling, coupling devices or accessories needed to change jobs!**

The new Stewart-Warner Industrial Balancers not only give you lowest first cost, but cut the cost of balancing *per piece* so low that even smallest shops can now afford their own precision balancing equipment! Handle single-piece, short-run and long-run production, as well as maintenance of your own machines. Semi-skilled workers can learn to operate them in one day! Extremely versatile, sturdy, accurate, engineered for years of service.

Only the Stewart-Warner Balancers Offer These Maximum and Minimum Ranges:

	Weight Range	Diametral Range	Length Range	Sensitivity
Model 704	½ lb. to 1000	½" to 44"	4½" to 55"	0.01 inch-oz.
Model 708 Portable	1 lb. to 5000	1" to 68"	7" to 83"	0.04 inch-oz.

In-place balancing of all rotating machinery.

Write for FREE illustrated brochure on industrial balancing

STEWART SW WARNER

STEWART-WARNER CORPORATION

Stewart-Warner Corporation, Dept. F-27
1834 Diversey Parkway, Chicago 14, Illinois
Please mail me all the facts about Stewart-Warner Industrial Balancers.

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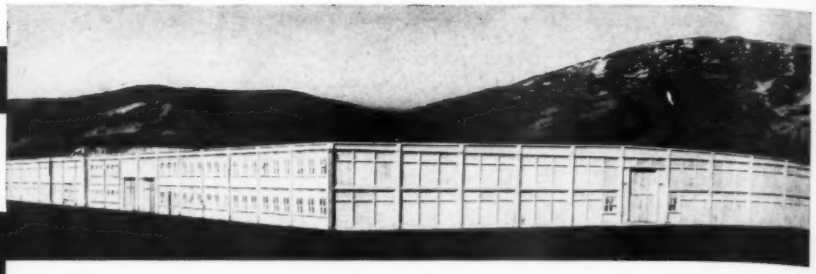
CIRCLE INFORM-A-GRAM KEY NO. 2373

At Narsarssuak



ONE ROTABIN-EQUIPPED WAREHOUSE NOW STORES 32,000 SUPPLY ITEMS

Between 800 and 1000 line items are stored conveniently in each 3-foot-diameter Rotabin at the new base supply warehouse at Narsarssuak Air Base (NEAC).

Before the new warehouse was built, base supplies had been stored in 55 temporary shelters. Now, the space savings inherent in Rotabin storage methods bring all items into easy accessibility—a vital factor in Narsarssuak's snow-isolated efficiency.

"How to Double Your Warehouse Capacity" is a free booklet showing how diverse warehousing operations have benefited through F-G-M know-how. Send for it.

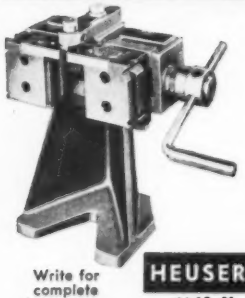
The Frick-Gallagher Mfg. Co.
106 So. Michigan Ave.
Wellston, Ohio.

FGM

Technique and Know-How
. . . increases storage capacity
. . . reduces servicing time

CIRCLE INFORM-A-GRAM KEY NO. 2381

SPEED UP DRILLING & TAPPING JOBS!



JOHN'S DRILL JIG

For cross or end drilling round, hexagon, or square stock or standard or odd-shaped rough castings from ⅛" to 8" O.D. Will cut tooling and production costs to minimum—10 to 100,000 pieces.

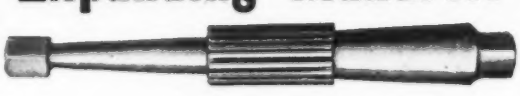
Standard removable slip fit bushings and holders available to drill center or mean off-center. The self-centering action will hold within .0015" or better regardless of jig wear or piece part O.D. variation. Jigs available in three sizes 6", 8", 14"; jaw openings 2", 3¼", 7½".

Write for complete information.

HEUSER MANUFACTURING CO.
1042 N. Pauline St., Chicago 22, Illinois.

CIRCLE INFORM-A-GRAM KEY NO. 2382

Expanding Mandrels



Accuracy 001" - No Distortion
No Slipping - Everlasting

K.O. LEE CO.
ABERDEEN, SOUTH DAKOTA

If it's made by Lee *it's a* "Knock-Out"

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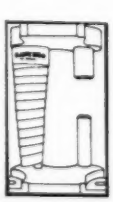
ON Dies EQUIPPED WITH
ELASTICONE GUIDE PIN COVERS



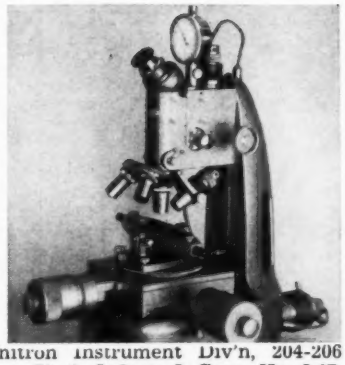
Day after day, year after year, manufacturers of ALL products are discovering how Elasticone Guide Pin Covers can work for them . . cutting die costs by eliminating the need for spare dies. Inexpensive Elasticones close the gap between pins and bushings, protecting dies against breakage . . protecting workers against injuries. Available in sizes to fit most pins and bushings.

Write for complete literature and new Technical Bulletin 53

CENTRAL Safety Equipment Co.
6603 Marsden St. PHILADELPHIA 35, PA.

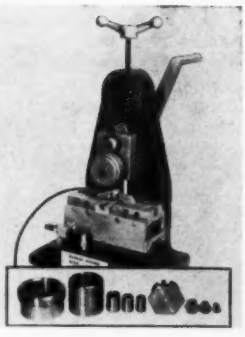
CIRCLE INFORM-A-GRAM KEY NO. 2384

Direct Readings to 0.0001" in three dimensions are a feature of Model TM Unitron toolmakers and metallurgical microscope. The readings are made by means of large micrometer drums which move the stage and a dial indicator which measures depth by optical contact with the specimen. United Scientific Co., Unitron Instrument Div'n, 204-206 Milk St., Boston 9, or — **Circle Inform-A-Gram No. A47.**



Mark around the Circumference of Sleeves and on the edge of hex plugs of various sizes with a new modification of the GRD stamping fixture. Style B fixture uses cradles for circumference of sleeves and a special table for marking hexes. The insert shows types of parts which can be marked. M. E. Cunningham Co., 1068 Chateau St., Pittsburgh 33, or —

Circle Inform-A-Gram A50.

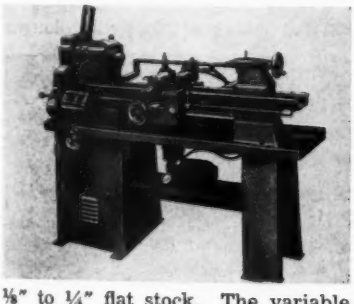


Save 75% of Setup Time with a press brake positioning gage. Model 750 eliminates the old method of using clamps and make-shift setups. Two or a series of gages are fastened

to a bar in the rear of the press brake. They can be set in any position by sliding them to the desired location on the bar and locking them with two thumb screws. Addresso Mfg. Co., 9105 W. King St., Franklin Park, Ill., or —

Circle Inform-A-Gram No. A48.

Automatic Reproduction of Multiple Diameters, tapers, bevels, shoulders, radii, grooves and chamfers is provided by a heavy-duty duplicating lathe. The Clausing 12" hydraulic tracer lathe has a template mounting designed for templates made of



⅛" to ¼" flat stock. The variable speed drive makes available instantly any spindle speed from 43 to 222 and 250 to 1300 rpm without stopping the lathe or shifting belts. Atlas Press Co., Clausing Div'n, 21115 N. Pitcher St., Kalamazoo, Mich., or —

Circle Inform-A-Gram No. A49.

An Even Better DIMENSIONAIR

WITH THE SAME BASIC, NO-DRIFT SYSTEM

New important refinements have been built into the Dimensionair.

Most air lines installed in plants were NEVER INTENDED to be used for precision instruments of any kind. Hence, the Dimensionair is now made EVEN MORE IMMUNE to unclean air and variations in air pressures. The meter is protected from dirt, oil and water.

Zero setting adjustment is positive and fast. No resetting is required. You do not have to balance the zero setting against the regulating pressure.

One third smaller size makes gage EASIER TO HANDLE and more adaptable for use on machine tools.

All components easily accessible. One-piece top and front easily removed with all components and connections attached. Quick, easy servicing, if necessary.

In every way the Dimensionair provides you with constant accuracy and GREATER DEPENDABILITY, adaptability and service. That's why more and more inspection people buy it. Why don't YOU try it? Write or call us or our nearest office.

ONLY AIR GAGE WITH BUILT-IN ACCURACY THAT ENABLES USE OF ONE MASTER

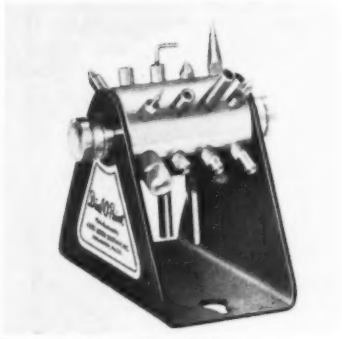
FEDERAL PRODUCTS CORPORATION
7232 Eddy Street • Providence 1, R. I.

Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

CIRCLE INFORM-A-GRAM KEY NO. 239



This Dial-O-Point Accessories Set is adaptable to all standard dial indicators. It makes possible a quick selection of the accessory necessary for measuring. The set in a stand (shown) includes 20 contact points, a thread adapter, a top lift and two extensions. Aero Screw Co., Inc., Burlington, Mass., or — **Circle Inform-A-Gram No. A51.**

Designed for Drilling Hardened Ferrous Materials with a Rockwell range of C-40 to C-65 and above, are Hi-Brinell Drills. They are available from stock in new sizes ranging from 1/16" to 3/4". These drills are ideal for any toolroom, die shop and machine repair applications. They are also produced in special sizes for specific applications. Ace Drill Corp., Adrian, Mich., **Circle Inform-A-Gram A52.**

WHY . . . Should You Measure To MILLIONTHS OF AN INCH?

All gaging authorities agree that it is necessary to gage to an accuracy 10 TIMES GREATER than the desired working tolerance. Therefore, if your tolerances are .0005" or less, you should use a gage accurate to 50 millionths of an inch to assure proper dimensional control. Conventional mechanical indicators cannot maintain, or repeat this degree of accuracy.

Industry is finding the electronic indicator not only more accurate and repeatable, but also less subject to damage than conventional mechanical indicators. In addition, its simplicity of operation enables any operator, who can use a dial indicator or micrometer properly, to measure accurately to millionths of an inch.

Simple And Easy To Read To MILLIONTHS OF AN INCH . . .

The INDI-AC ELECTRONIC INDICATOR is merely set to the required dimension with standard gage blocks. The parts to be gaged are then placed under the gage tip and the meter indicates the variations from the desired dimension MAGNIFIED UP TO 10,000 TIMES! Thus it is far simpler and easier to read than a dial indicator or micrometer.

This versatile instrument is used for all gaging purposes such as surface plate or height gage work, checking setups, runout or alignment of parts or machines.

Using the INDI-AC, tolerances which you now estimate will be easy to work to and measure.

WRITE for further details on the *new* INDI-AC and other Electronic Production Gages, TODAY!

Cleveland INSTRUMENT COMPANY, INC.
738 Carnegie Avenue • Cleveland 15, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 240

A Wide Range of Wheel Dressing Operations can be performed with one size of diamond, reducing inventories, using the Citco Turnit Tool. No removal of the diamond tool is necessary when turning. A mere flick of the wrist turns the diamond.

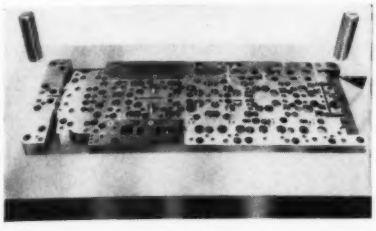
Diamonds stay sharp longer assuring a consistently accurate wheel dress. Citco Turnit Tools are offered in 1/4", 3/8" and 7/16" shank dia. The Cleveland Industrial Tool Co., Inc., Skaneateles, N. Y., or —
Circle Inform-A-Gram No. A53.

Polish Either 2B Roll Mill Sheets or Formed Flat Surfaces to an equivalent No. 4 finish or better with Model 43-R3 automatic polishing machine. It uses a hydraulic system to power a traveling head at 80 to 90 8-ft strokes/min, with longer

strokes possible. This machine with a 6" wide abrasive belt can also be used for weld removal, surface cleaning prior to painting, scale removal and filler sanding. The Carborundum Co., Curtis Machine Div'n, Jamestown, N. Y., or —
Circle Inform-A-Gram No. A54.

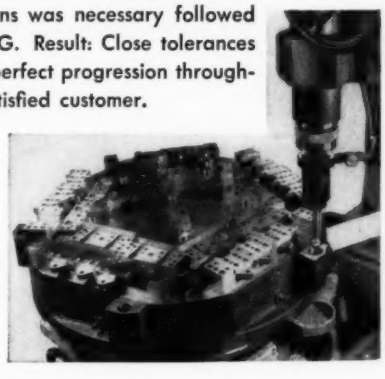
Holes
JIG GROUND with *Vulcanaire*

Provide yourself with this inexpensive* instrument for use on your present equipment and JIG GRIND with a guarantee.



41ST year of Vulcan service.

A seven station die from Vulcan's contract Tool Room. Standard sized punches and buttons were used. But since forming and piercing operations were involved hardening of the sections was necessary followed by JIG GRINDING. Result: Close tolerances held easily and perfect progression throughout — another satisfied customer.



Borrow our instructive 11 minute movie on Jig Grinding.

A five station indexing fixture from Vulcan's contract Tool Room. Using a jig borer index table with the Vulcanaire 5 indexing holes and 35 locating and clamping holes were JIG GROUND in place. Result — eliminated all close locating and dowelling of individual parts, and of course hours of time.

*Vulcanaire equipment pays for itself on the first job.

Services of YOUR TOOL ROOM in Dayton

Engineering, Processing, Designing . . . Special Tools . . . Dies . . . Special Machines . . . Vulcamatic Transfer Machines . . . Automation . . . including the Vulcan Hydraulics that Form, Pierce, Assemble and Size . . . Vulcanaire Grinding Heads . . . Motorized Rotary Tables . . . Plastic Tooling . . . Vulcanaire Jig Grinders.

VULCAN TOOL CO.

741 LORAIN AVE. • DAYTON 10, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 2411

Punches and Dies

...for foot and power presses

Standard Punches and Dies of all sizes and shapes in stock—or made promptly to order. Also Adaptors and Die Shoes to convert your press. For power, foot or hand operation.

Round, square, rectangular, slotting, notching, louvre, angle, multiple, knock-out and other shapes. Precision made from high grade tool steel. More than 25,000 sets in stock to choose from.

Send for free illustrated catalog No. 154-AF NET PRICE SHOWN! ***What are your punch and die needs?***

WARD Machinery Co. 564 West Washington **Chicago 6**

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IVORYTON, CONN.

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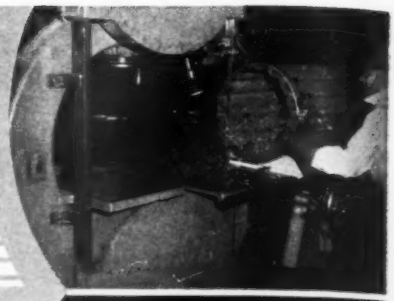
CIRCLE INFORM-A-GRAM KEY NO. 2413

FRICTION SAWING with Tannewitz HIGH SPEED BAND SAWS

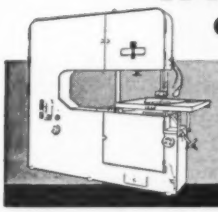


FASTEST, BEST MEANS OF CUTTING METALS

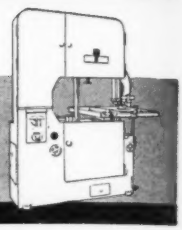
If you are not familiar with the advantages of friction sawing with these machines, by all means drop us a line asking for "Friction Sawing Data." You can save many times the cost of a Tannewitz High Speed Band Saw and greatly expedite production by using it to cut sheets of both hard and soft steel, formed or flat, trimming malleable and steel castings, cutting armor plate or many other materials. Write NOW!

THE **TANNEWITZ WORKS**

GRAND RAPIDS, MICHIGAN ☎ GL-6-1729



TANNEWITZ DI-SAWS — 24", 36", 48", 60" CAPACITIES
for CONTOUR SAWING, FILING, POLISHING
The smoothest, fastest, most trouble-free Di-Saws on the market. Write for bulletin.



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HOW TO.... DEBURR THESE INACCESSIBLE HOLE FACES BY MACHINE OPERATION with the amazing NOBUR TOOL

★ FASTER
★ EASIER

No more hand finishing methods for those hard-to-get-at inner surfaces on multi-wall parts. The NOBUR Tool with its double edge cutting blade does the job in seconds . . . all by **machine operation.** Can be used by anyone, with complete safety, on your own lathe, drill press, etc. Simple to operate.

1. Insert NOBUR tool in any machine spindle. A light pressure of the revolving cutter blade against the workpiece quickly deburrs the outside surface.
2. After outside surface is deburred, slide knurled sleeve back to fully retract the cutter-blade below pilot body diameter.
3. With cutter-blade retracted move workpiece or tool to position for deburring inside surface. Raise cutter-blade to deburr first one surface then the other.

Write for FREE Folder
Send for all details on Nobur Tool Products TODAY!

N-11

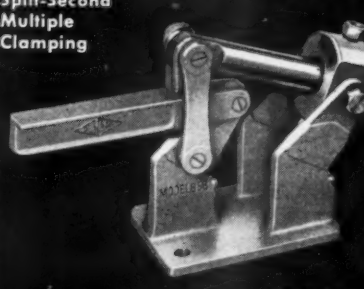
NO/BUR TOOLS **NOBUR MANUFACTURING CO.**
6860 Fairdale Ave. No. Hollywood, California

CIRCLE INFORM-A-GRAM KEY NO. 2422

presenting...the NEW

DE-STA-CO **Clamp-omatic**
AIR OPERATED
TOGGLE CLAMP

for Positive Split-Second Multiple Clamping



MODEL 858
18¼" long
8" high
4" wide

- EXTRA HEAVY DUTY
- HARDENED BUSHINGS at all pivot points
- COMPONENTS EASILY REPLACED due to screw-type construction
- FORGED STEEL COMPONENTS

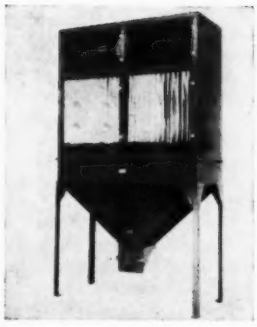
Holding Pressure to 2,000 Pounds with Normal Air Line Pressure of 90 Pounds. Weight 16 lbs.

Write today for Literature on this new DE-STA-CO CLAMP-OMATIC, Model 858, as well as Models 810-U and 810-S.

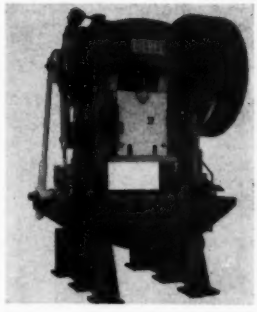
DE-STA-CO **DETROIT STAMPING COMPANY**
WORLD'S FIRST LINE OF TOGGLE CLAMPS
344 Midland Avenue • Detroit 3, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 2423

Model 123 Dust Collector, the largest in the Torit cabinet line, will handle heavy-duty continuous grinding and other high dust volume sources. It has a dust storage capacity of 10 cu ft and a filter area of 300 sq ft. Model 123 can take care of as many as eight grinding wheels at a time. Torit Mfg. Co., Dept. KP, 287 Walnut St., St. Paul 2, Minn., or — **Circle Inform-A-Gram A55.**



Lamination Work, progressive blanking and forming and large blanking work can be handled by 150-ton Diebel Hi Production Automatic Press. Its speed range is 70-210 spm. The width of feed is 18" and the length, 0-13⅝". Di Machine Corp., Dept. P, 2711 W. Irving Park Rd., Chicago 18, or — **Circle Inform-A-Gram A59.**



Offset Routing or Overlay Template Work can be done with the Power-Assist Rigidmil Router. With the power-assist mechanism, the operator does not actually supply the

force required to feed the cutter through the work. Sizable work capacity is provided by a 4-speed vertical spindle head rated at 15 hp at 7,200 rpm. Sundstrand Machine Tool Co., Rockford, Ill., or — **A56.**

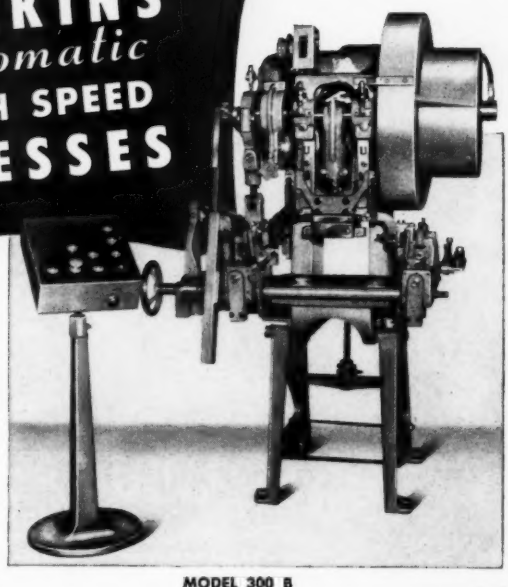
A Liquid Spring Shok using liquid compressibility and dampening provides a 10,000 lb spring with a 1,000-lb preload. Model 28112-16 is designed to cushion the impact of a 10,000-lb mass moving into a mechanical stop. It is 3½" dia by 14" long excluding trunnions. Taylor Devices Inc., 188 Main St., North Tonawanda, N. Y., will provide a copy of Data Book S with details, or **Circle Inform-A-Gram No. A57.**

A Materials Handling System has been announced by Vac-U-Lift Co., Box 298, Salem, Ill. The Vac-U-Lift incorporates the principle of induced vacuum in connection with Vac-U-Pads, which are of metal construc-

tion in various shapes to fit particular applications. The system is used in the handling of non-porous materials where size, flexing and surface protection are important considerations. **Circle Inform-A-Gram No. A58.**

AUTOMATION!

PERKINS *automatic* HIGH SPEED PRESSES



Wichita Air Clutch

Double Roll Feed with By-Pass Top Lifts

Scrap Chopper

Pedestal Control

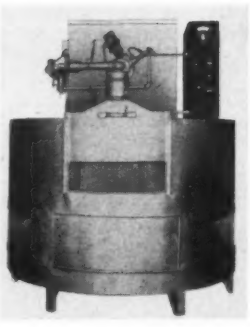
MODEL 300 B

Here is an automatic machine that will give you the most efficient speed and best production. It is equipped with an accurate double roll feed which has a by-pass type of automatic lifts, a scrap chopper actuated from the crankshaft, a variable speed drive, a Wichita Air Clutch, pedestal type of press controls, and variable top stop control. It is equipped with automatic lubrication and bronze gibs. Built in sizes of 10, 15, 20, 27, 35, 45, 60, 75 and 100 tons capacity.

PERKINS
MACHINE CO. WARREN, MASS.
PRESS BUILDERS FOR OVER 50 YEARS

CIRCLE INFORM-A-GRAM KEY NO. 243

A Rotary Hearth Oven has been designed to permit loading and unloading from the same position by a single operator. At the same time, it permits a continuous movement of work in and out of the heating zone. Standard speed range is from 2" to 10" per min or about one to five revolutions per hr. Grieve-Hendry Co., Inc., 1401 W. Carroll Ave., Chicago 7, or —
Circle Inform-A-Gram A60.



A New Agitator Tank Attachment permits both coarse and fine lapping on Model 24 Lapmaster. In cases where lapping tolerances are not critical, it is unnecessary to change laps and conditioning rings when switching from one tank to the other. Cleaning of the lap plate is all that is required. Crane Packing Co., Dept. TPC, 6400 Oakton St., Morton Grove, Ill., or —
Circle Inform-A-Gram A61.

ARMSTRONG

The ARMSTRONG Threading Tool takes interchangeable high speed steel form-cutters which require only flat top grinding to resharpen—always hold their true thread form.

Write for catalog

Each year ARMSTRONG TOOL HOLDERS become more important to you

Every rise in labor costs, every added tax, every overhead burden, every increase in cutting steel prices, every new, more costly machine tool, all increase the importance of ARMSTRONG TOOL HOLDERS to profitable operation.

ARMSTRONG TOOL HOLDERS reduce direct tooling costs to an absolute minimum—"Saves: All Forging, 70% Grinding, 90% High Speed Steel."

ARMSTRONG TOOL HOLDERS reduce tooling-up time to minutes, to the selection and adjustment of the holder and cutter.

ARMSTRONG TOOL HOLDERS permit increased speeds and feeds —produce more pieces per hour per machine tool.

ARMSTRONG TOOL HOLDERS are efficient for they embody a perfection gained by over 50 years of specialization in the development and refinement of tool holders.

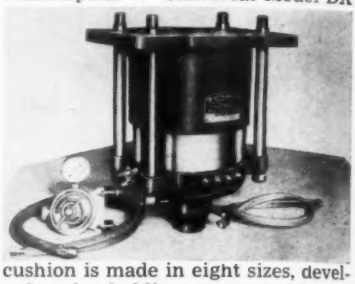
ARMSTRONG TOOL HOLDERS are inexpensive because they are quantity produced by modern methods, for a world market . . . are used by over 96% of the machine shops and tool rooms . . . are carried in stock for your convenience by all industrial distributors of consequence.

Buy ARMSTRONG TOOLS from your Industrial Distributor

ARMSTRONG BROS. TOOL CO. "The Tool Holder People" 5220 W. ARMSTRONG AVENUE CHICAGO 30, ILL.

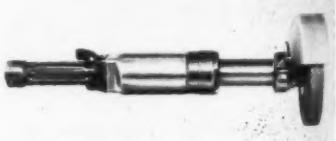
CIRCLE INFORM-A-GRAM KEY NO. 244

An Improved Pneumatic Die Cushion for punch presses is now available from Dayton Rogers Mfg. Co., Minneapolis 7. Universal Model DX



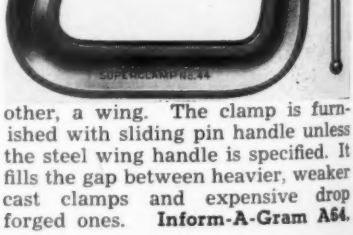
cushion is made in eight sizes, developing ring holding pressure of 1 to 20 tons on standard shop air line. It comes complete ready to install on any punch press.
Circle Inform-A-Gram No. A62.

A Lightweight 6" Air Grinder with an improved motor that is 50% more powerful than previous models has been produced by Thor Power Tool Co., Aurora, Ill. The new 4G Series



that is manufactured in 12 models, is available in speeds of 4,500, 6,000, 9,000 and 12,000 rpm and comes in butterfly, grip and lever type throttles. It supersedes the company's 250 Series. **Inform-A-Gram A63.**

No. 44 Superclamp Twins have been introduced by The Cincinnati Tool Co., Cincinnati 12, O. These C clamps are identical except for the handle, one is a pin type and the



other, a wing. The clamp is furnished with sliding pin handle unless the steel wing handle is specified. It fills the gap between heavier, weaker cast clamps and expensive drop forged ones. **Inform-A-Gram A64.**

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ROLL TEST THEM RAPIDLY ACCURATELY with the

SCHERR 5" CENTER DISTANCE FINE PITCH GEAR TESTER

Fine Pitch Precision Gears are quickly tested for runout of Pitch Diameter, Spacing and Tooth Form Errors.

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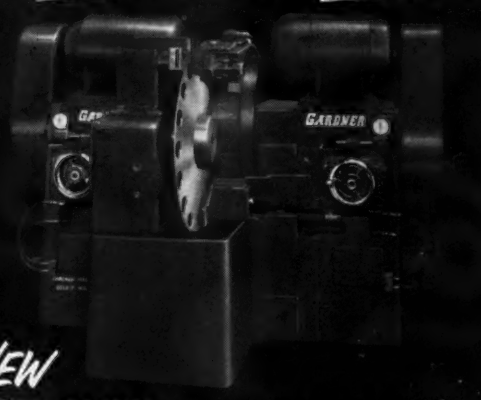
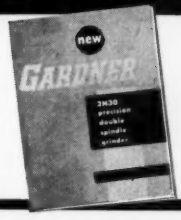
grinds **TWO** parallel surfaces in **ONE** operation



NEW **GARDNER** *Precision Disc Grinder*

Model 2H30 Double Spindle Grinder with improved stability for greater accuracy



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GARDNER precision disc grinders

MACHINE COMPANY
416 Gardner Street
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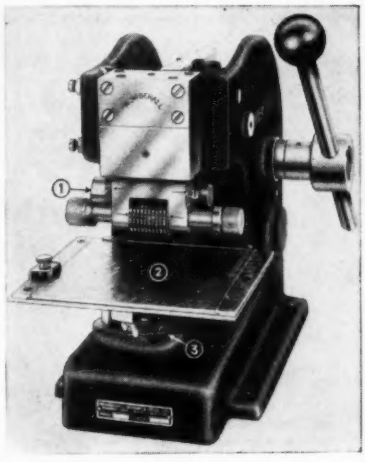
CIRCLE INFORM-A-GRAM KEY NO. 2453

NEW BENCH NUMBERING PRESS MODEL 136



This new small, light, compact Press was designed for stamping small Name Plates and small flat articles with up to ⅛" high characters.

It weighs only 65 lbs. yet has the power and strength of a press much larger in size.

Its compactness, and small size, combined with its power, should be very welcome where saving of valuable space and leaving larger power presses free for other work is of importance.

The model 136 is hand operated, using a cam to obtain pressure. The fact that this press has only three moving parts makes it extremely easy to maintain.

Any Numbering Machine, automatic or non-automatic, Typeholders with interchangeable Steel Type, or Special Dies can be operated in this Press.

Write for bulletin TP-136

NUMBERALL STAMP & TOOL CO.

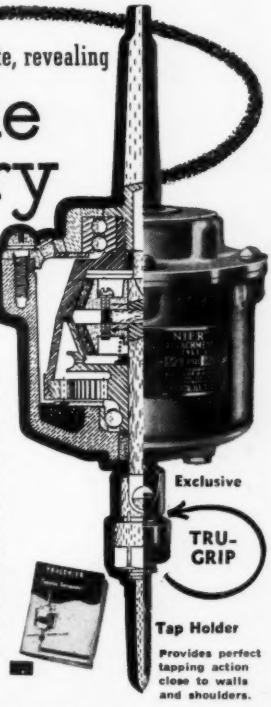
HUGUENOT PARK STATEN ISLAND 12, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 2452

Get the complete, revealing

Inside Story

on the finest tapping heads ever made!



A complete feature by feature analysis on the amazing Procunier Tapping Line is yours for the asking! Gives a true "peephole" story on the many outstanding construction improvements, the mechanical advancements and precision quality operating advantages that make Procunier heads a "must" in production plants everywhere! You'll learn why Procunier means more tapping hours with minimum "down-time", faster production with fewer broken taps, fewer spoiled pieces and a "new-found" operating ease that helps operators maintain stepped-up production schedules. Find out how you, too, can benefit with Procunier in your plant.

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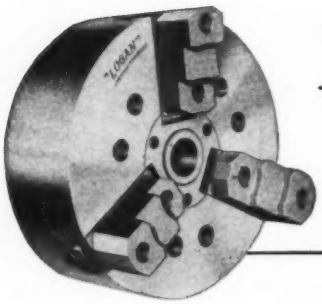
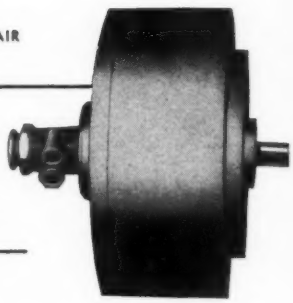


LOGAN ROTATING AIR CYLINDER

LOGAN 3-JAW CHUCK



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FOR YOUR CHUCKING REQUIREMENTS

Logan precision-made chucks are at home in any production picture. You can depend on Logan two and three jaw chucks for positive holding action on any shape work. Logan engineers will welcome the opportunity to help you solve your difficult chucking problems.

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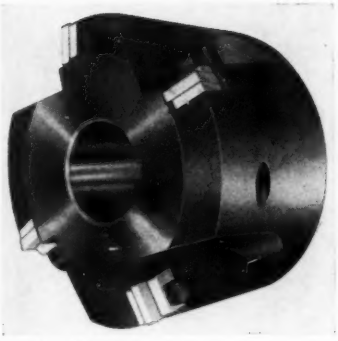
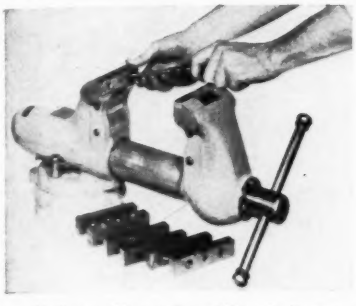


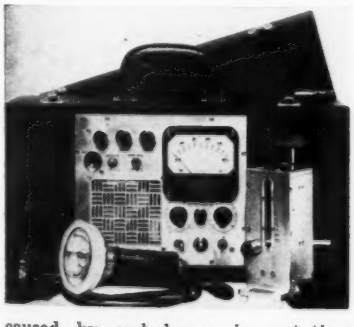
This Kendex Boring Head has been developed for boring engine cylinders with all the advantages obtainable from carbide cutting edges. It uses four ½-in-sq turnover button inserts which have eight indexable cutting edges per insert. Boring heads of this type for engine cylinders of any size are built to specifications by Kennametal Inc., Latrobe, Pa., or -- **A65.**

Interchangeable Jaw Faces made in five different materials help make Wilton machinists vises work better and last longer. By keeping a complete set of faces on hand, the full gripping force of the vise can be



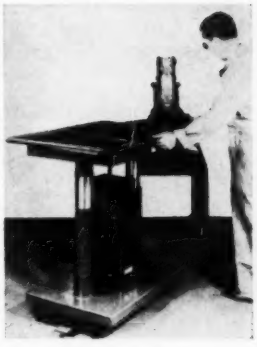
applied to all work without danger of slipping and damage to the workpiece. In addition, universal brass and copper jaw caps are available to fit over any of the steel or fibre jaw faces. Wilton Tool Mfg. Co., Inc., Schiller Park, Ill., or —
Circle Inform-A-Gram No. A66.

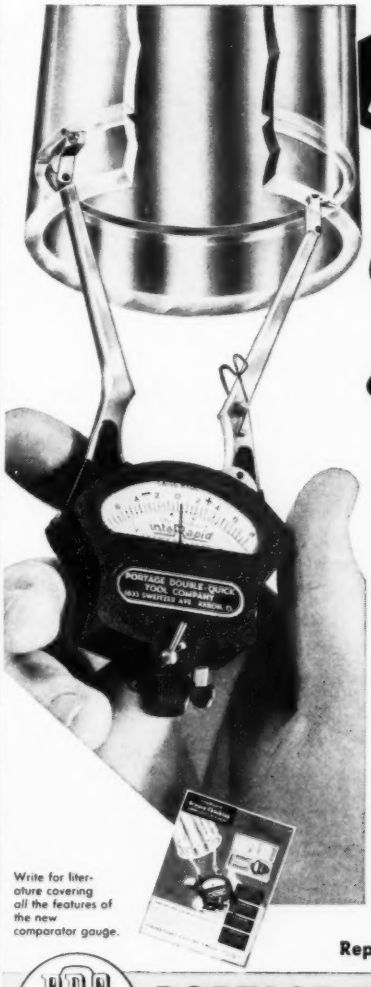
Balance Parts or Assemblies operating between 225 and 3600 rpm with the Vibrodyne Balancer. This portable unit with a standard turntable pick-up will meet all in-place balancing requirements. It is used for detecting and correcting vibration



caused by unbalance in rotating parts. Details are in Bulletin 53 issued by Tinius Olsen Testing Machine Co., Easton Rd., Willow Grove, Pa., or —
Circle Inform-A-Gram No. A67.

Save Time and Increase Production with the Lexco 500 lightweight hydraulic lift table. It can serve as an adjustable work bench, welder's positioning table or leveling table for presses and conveyors. The lift table with a 500-lb capacity can also be used for lifting and moving castings, dies, machine accessories and tools. Lexco Engineering & Mfg. Corp., P. O. Box 161, Colmar, Pa., or —
Circle Inform-A-Gram A68.





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Sets come complete with both short and long groove tips, special "flat bottom" tips, button tips, centering arms, spare screws, special socket wrench and screw driver, all in one compact, sturdy case. Units measure internal grooves from 3/8" to 6"

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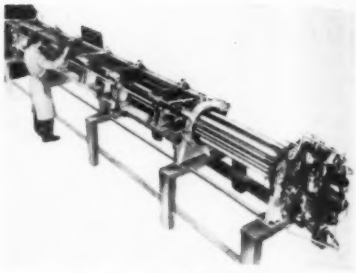
Increase Production from Multiple-Spindle Bar Automatics with an automatic loader. The multiple-spindle bar feed automatically indexes to as many as eight fixed-stop positions, holds several hours' supply of stock, ejects remnants and reloads. It can accommodate 2" maximum and ¼" minimum stock sizes. The operation of the machine involves no manual adjustment during the production run. Lipe-Rollway Corp., Syracuse, N. Y., or — **Circle No. A70.**



Handle Narrow Width Coils in capacities of from 1000 lbs to 5000 lbs with Model 369 coil grab. It is designed to assist firms that slit wide coil according to desired specifications. The hoist hook engages the grab direct, eliminating the need for roller chain. H. L. Bushman Co., Inc., 100 W. Central Ave., Roselle, Ill., or — **Circle Inform-A-Gram No. A71.**

Detect Lead Error in straight and tapered work and rack teeth with an electronic lead measuring instrument. The Leadchek has higher amplification permitting closer tolerance inspection. It will handle work up to 36" long and 10" dia with standard tailstocks. Used with V-block accessory any length work ½" to 6" dia can be checked. The Sheffield Corp., Dayton 1, O., or — **Circle Inform-A-Gram No. A72.**

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NOW you can get a boring head that will BORE, FACE, TURN and GROOVE at no more cost than you would pay for a plain, single purpose boring head.

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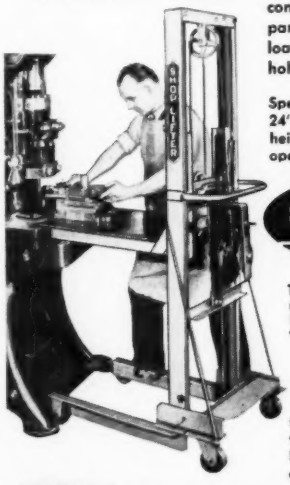

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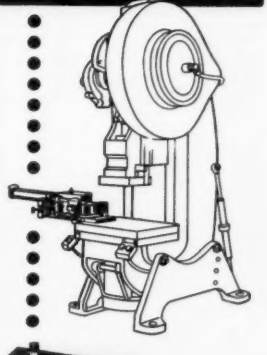

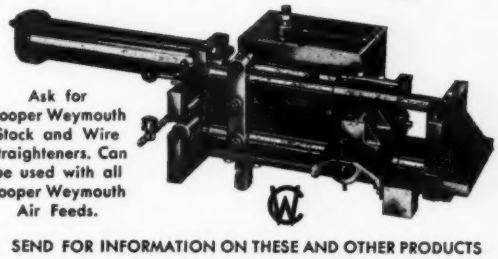

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- Super-strong.
- Flange construction.
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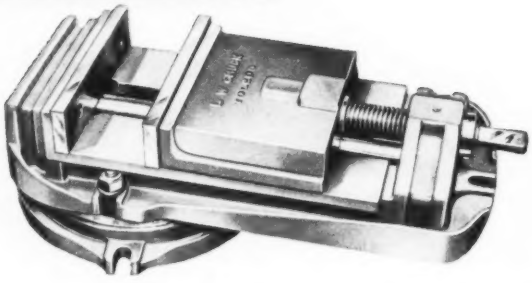

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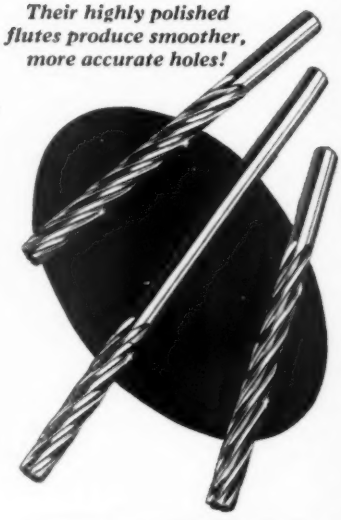
Their highly polished flutes produce smoother, more accurate holes!



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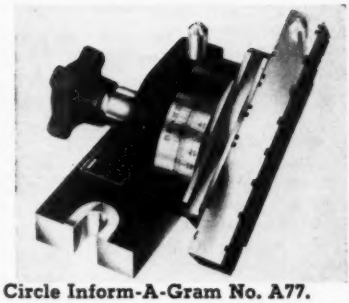
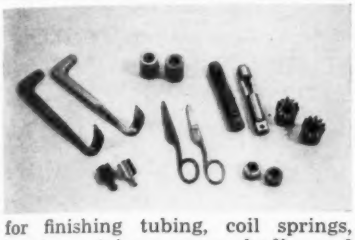
Measure Dimensional Variations of from 10 millionths to 10 thousandths of an inch with Model IA-515 Indi-Ac electronic indicator. It is designed for shop inspection and gage room use in gaging surface plate or height work and checking setups. Cleveland Instrument Co., Inc., 735-737 Carnegie Ave., Cleveland 15, or **Circle Inform-A-Gram A73.**

G-2 Angle Dresser and Toolholder is used to set up small jobs to be milled, drilled, tapped, etc. on any desired angle. It has an easy-to-read vernier scale 0° to 180° guaranteeing accuracy within 2 min of 1°. Rothfuss Tool Co., Box 2804, Providence 7, R. I., or — **Circle Inform-A-Gram No. A77.**

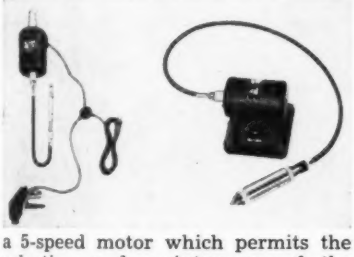


Barrel Finish Hard-To-Contact Recesses or intricate shapes with Tumblex S abrasive spheres. These spheres come in five different diameters and are made of Alundum aluminum oxide abrasive. They are used



for finishing tubing, coil springs, bearing retainers, pump bodies and other parts where conventional tumbling abrasive tends to wedge or will not reach. Norton Co., Worcester 6, Mass., or — **Circle No. A74.**

Filing, Burring, Drilling, beveling, honing, polishing, etc. operations are handled by two new flexible shaft machines. The overhead machine features speeds up to 10,000 rpm. The bench-type flexible shaft unit utilizes



a 5-speed motor which permits the selection and maintenance of the proper speed from 1,500 to 10,000 rpm. L & R Mfg. Co., 577 Elm St., Arlington, N. J., or — **Circle No. A75.**

A Low-Cost Solenoid Valve for control of air, water, oils, gasoline and many other fluids and gases is being offered by The Skinner Chuck Co., Skinner Electric Valve Div'n, New Britain, Conn. C-Series valve

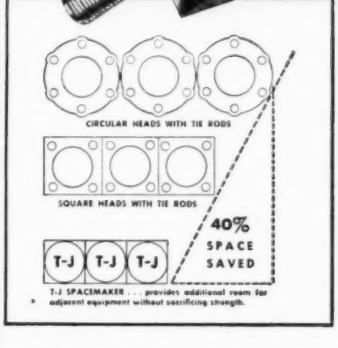
is compact, weighing only 12 oz. Pressures range from 60 to 130 psi. Details are found in Bulletin D11.1 supplied by the company, or — **Circle Inform-A-Gram No. A76.**

Saves 40% Space!

STRONGER, TOO

Than Outmoded Tie Rod Cylinders!

OFF SHELF DELIVERY


CIRCULAR HEADS WITH TIE RODS
SQUARE HEADS WITH TIE RODS
40% SPACE SAVED
T-J T-J T-J
T-J SPACEMAKER . . . provides additional room for adjacent equipment without sacrificing strength.

Only T-J Spacemaker CYLINDERS

Offer All The Extras As Standard!

- NEW *exclusive* Ingenious Cushion Designs . . . Super Cushion Flexible Seals for Air . . . New Self-Aligning Master Oil Cushion
- Compact design eliminates tie rods, saves up to 40% space
- Proven Performance . . . with Extra High Safety Factor
- Hard Chrome Plated Bodies and Piston Rods (Standard, at no extra cost).
- OIL pressure to 750—AIR to 200 P.S.I.

You'll find many answers to automation in your plant with T-J Spacemaker Cylinders! Designed with years-ahead features for top performance and dependability. Wide range of styles, capacities . . . for all kinds of push-pull-lift operations . . . reduces man-hours and costs! Write The Tomkins-Johnson Co., Jackson, Mich.

MEMBER OF THE NATIONAL FLUID POWER ASSOCIATION

NEW LITERATURE . . . send today for new Bulletin with complete details of Spacemaker line.

T-J TOMKINS-JOHNSON

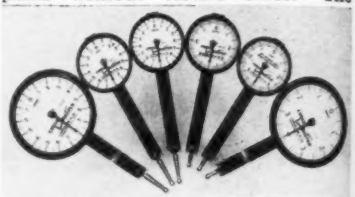
VALVES · AIR AND HYDRAULIC CYLINDERS · CUTTERS · FITTINGS

CIRCLE INFORM-A-GRAM KEY NO. 251

Grind Extremely Small Holes in hardened steel up to Rockwell C-64 with 1903 Series of miniature hole grinding burs. All 17 different tools are on ⅛" shank. The bur removes up to 0.006" and 0.008" stock with a finish of 2 microinch or better. The Atrax Co., Newington, Conn., or — **Circle Inform-A-Gram No. A78.**

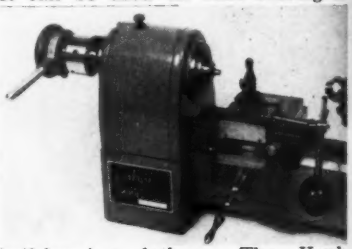
Designed for Counting and Controlling Applications is Model MEK-2094-AG electronic preset counter. It will count dependably from 0 to 5,000 counts/sec without special adjustment or circuit changes. The counter will operate with photo-electric, semi-conductor, magnetic or contact making pickups. Machinery Electrification, Inc., Northboro, Mass., or — **Circle Inform-A-Gram No. A79.**

The Check Master Test Indicator is now available in six models, including both regular and non-magnetic types. It responds to dimensional variations of 0.000020" and repeats without visible error. The



Check Master can be used on all types of fixtures, surface plate setups and for truing of pieces on machines. Standard Gage Co., Inc., Poughkeepsie, N. Y., or — **Circle No. A80.**

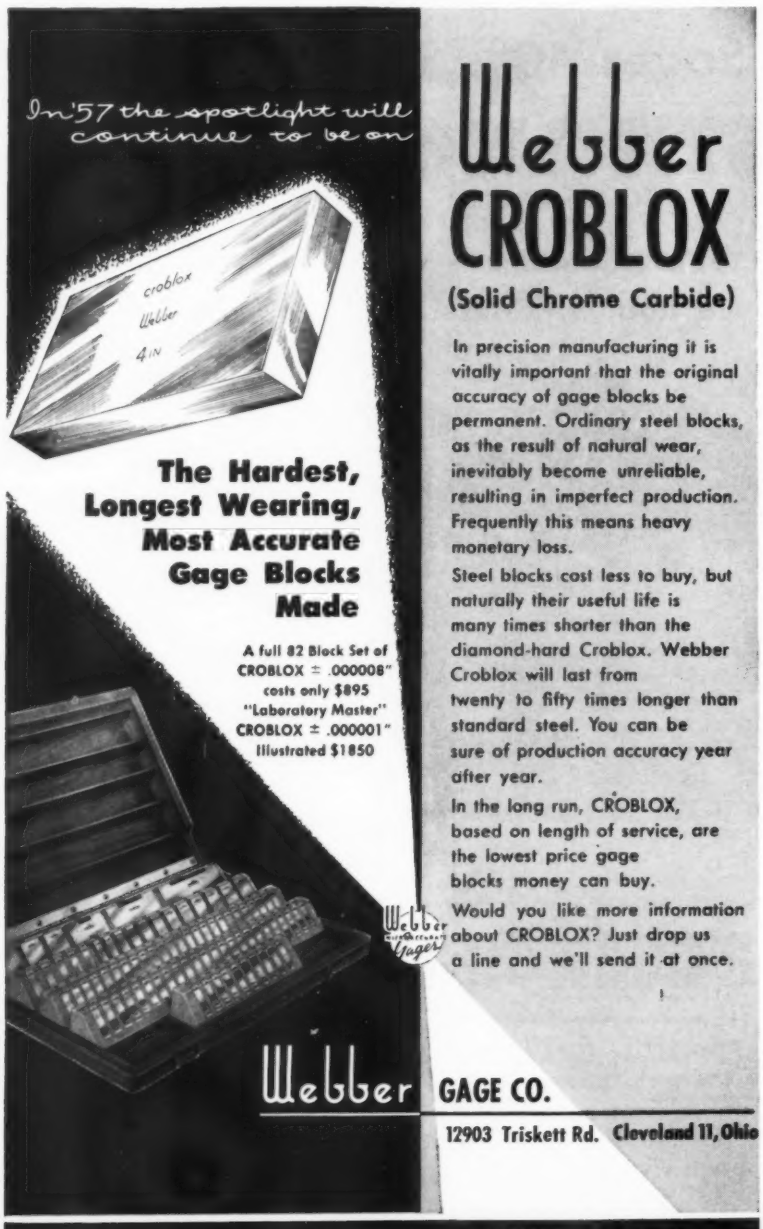
Adjust Collet Tension Quickly and change collets easily with the Hand-Quick collet closer produced by F. W. Derbyshire, Inc., Waltham, Mass. It can be used on cone-bearing or



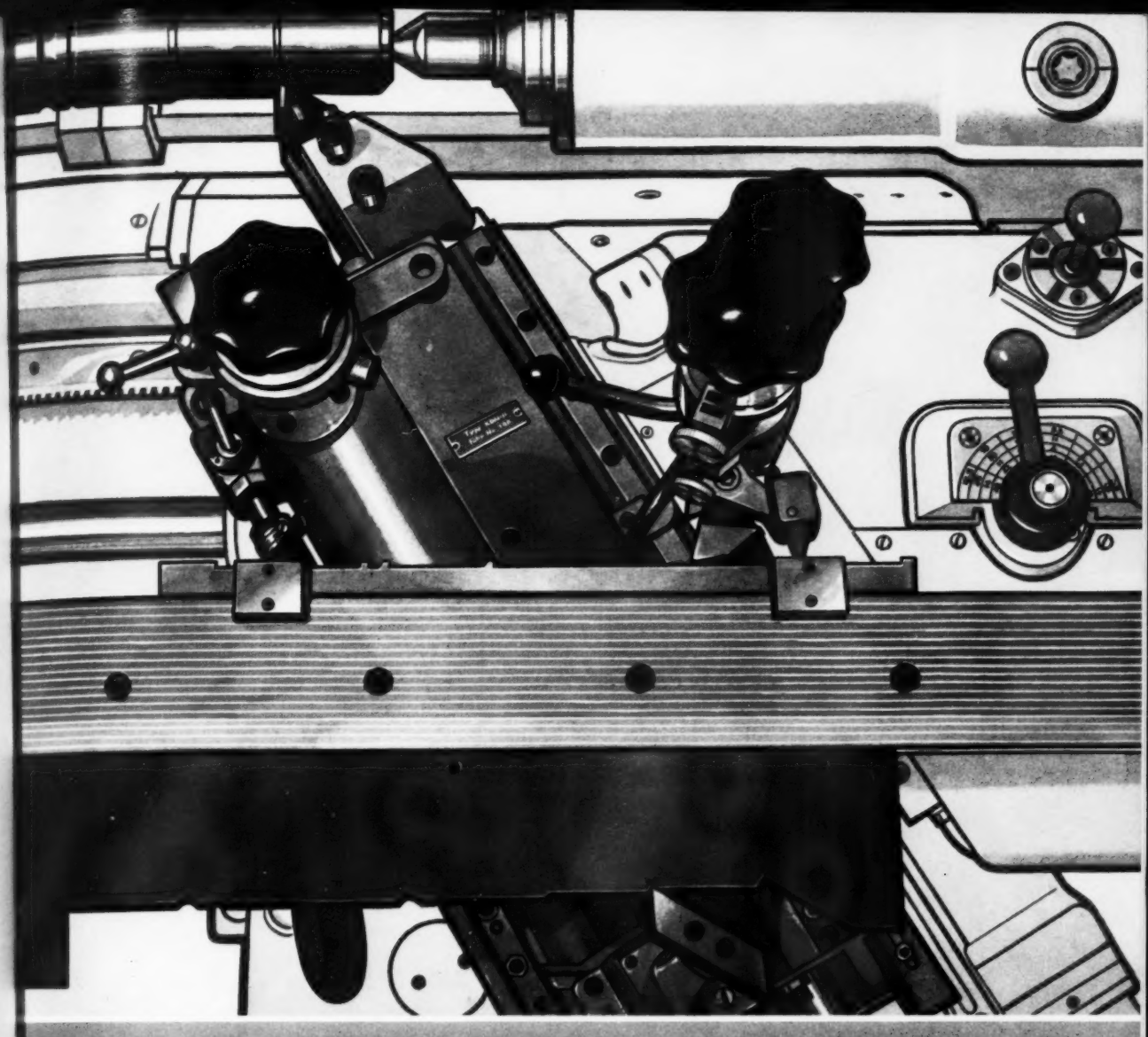
ball-bearing lathes. The Hand-Quick collet closer is shown mounted on the company's Model 750 lathe, but in addition, it will fit other lathe models. **Circle Inform-A-Gram A81.**

Relief Grinding of Step Drills, countersinks, taps, etc. is performed by a new cam-actuated relief grinder. The device uses a single solid

cam for infinite adjustment of clearance lift. Steptool Co., 3613 E. Olympic Blvd., Los Angeles 23, or — **Circle Inform-A-Gram No. A82.**


In '57 the spotlight will continue to be on
croblox
Webber
4 IN
The Hardest, Longest Wearing, Most Accurate Gage Blocks Made
A full 82 Block Set of CROBLOX ± .000008" costs only $895
"Laboratory Master" CROBLOX ± .000001" Illustrated $1850
Webber CROBLOX
(Solid Chrome Carbide)
In precision manufacturing it is vitally important that the original accuracy of gage blocks be permanent. Ordinary steel blocks, as the result of natural wear, inevitably become unreliable, resulting in imperfect production. Frequently this means heavy monetary loss.
Steel blocks cost less to buy, but naturally their useful life is many times shorter than the diamond-hard Croblox. Webber Croblox will last from twenty to fifty times longer than standard steel. You can be sure of production accuracy year after year.
In the long run, CROBLOX, based on length of service, are the lowest price gage blocks money can buy.
Would you like more information about CROBLOX? Just drop us a line and we'll send it at once.
Webber GAGE CO.
12903 Triskett Rd. Cleveland 11, Ohio
LARGEST EXCLUSIVE MANUFACTURER OF PRECISION GAGE BLOCKS

CIRCLE INFORM-A-GRAM KEY NO. 252



New Britain +GF+ outproduces multi-tool lathes with a single tool

How can one tool outproduce several? The answer is — maintain dimensional relationships with a template or prototype instead of a multi-tool setup. This cuts tool changeover time to practically zero.

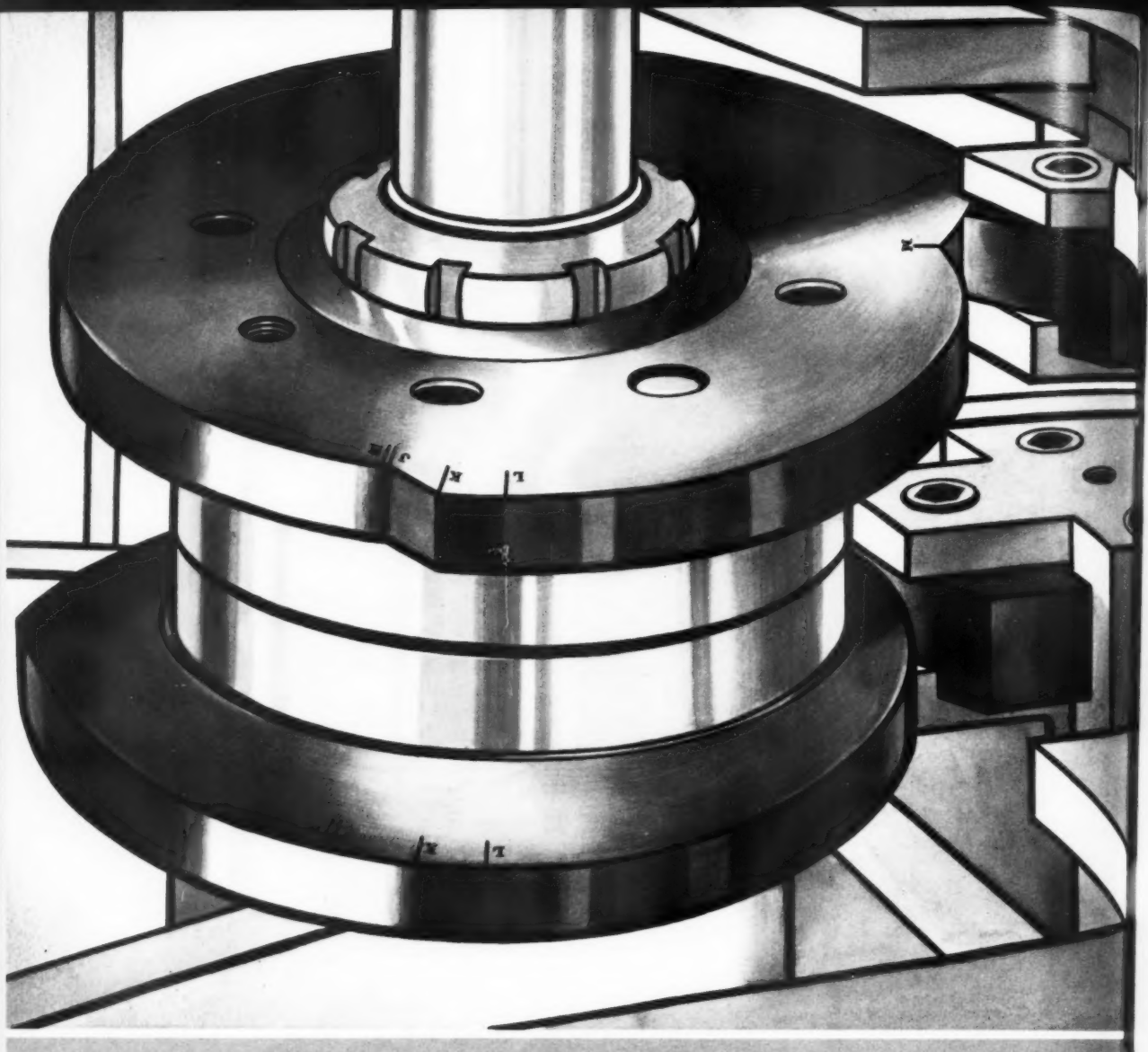
On the New Britain **+GF+** copying lathe, you can cut at maximum speeds and feeds for tool efficiency without worrying about tool wear and the delicate readjustment of several cutting tools. When the tool wears, change it, bring one dimension to size. The other dimensions have to be right. Your choice of a New Britain **+GF+** means elimination of any extra operation to bring pieces within grinding tolerances.

Machines from New Britain's three machine tool divisions incorporate the *basic principles* of more profitable production.

THE NEW BRITAIN MACHINE CO.

New Britain **+GF+**
Copying Lathe

NB



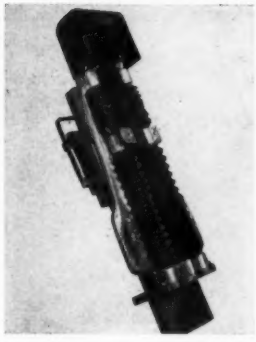
cams put the precision in precision boring

When you are working to "tenths" cams are your best method of maintaining accuracy, because cam control of the tool is *positive* control. The accuracy of parts produced on New Britain boring machines *can't* be affected by variable hydraulic pressures, ambient temperature, or play in complicated linkages.

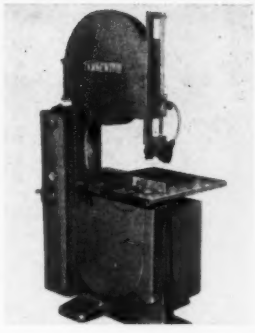
In boring machines or *any* machine tool investment, be sure your most important requirements are met, not by gadgets, but by the fundamental design principles employed. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

THE NEW BRITAIN MACHINE CO.
Precision Boring Machine
NB

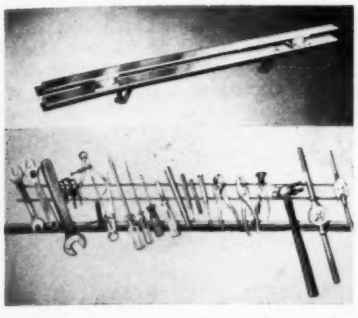
Apply 10" of Buffing Compound without Resetting with a new air-operated buffing compound applicator. Model 1006 can be installed on all types of buffing machines from simple lathes to multi-operation automatics. The applicator can feed any number of strokes/min, applying compound only when needed. Details are in Bulletin P-1000 from George L. Nankervis Co., 15300 Fullerton Ave., Detroit 27, or —
Circle No. A83.



Any Kind of Sawing can be performed by Model EV-24 variable-speed band saw. With 24" dia wheels, it is reported to be much more powerful than any other saw of this size and can be operated at any speed from 300 rpm to 6000 rpm. The saw is motor-driven and equipped with push-button controls. Details are in Bulletin EV-24 released by Tannewitz Works, Grand Rapids, Mich., or —
Circle No. A86.

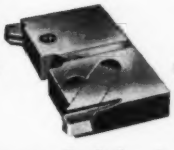


Fast, Convenient, Full-View Storage for Hand Tools is provided by a magnetic tool holder. The Magna-Bar eliminates tool rack nails, pegboards, slots, etc. It ends workbench clutter and misplaced tools, permitting faster, better work. Magnetrode Corp., Dept. AP, 1615 Main St., Kansas City 8, Mo., or —
Circle Inform-A-Gram No. A84.



Flat-Top Steel Conveyor Belting can be installed flush with the floor for heavy duty assembly work. It can also be used to handle parts, products or stock which are wider than the belt itself. The belt length, width, speed and carrying capacity can be varied to meet the needs of individual applications. May-Fran Engineering, Inc., 1726 Clarkstone Rd., Cleveland 12, or —
Circle Inform-A-Gram No. A85.

BUY U. S. SAVINGS BONDS

This tapered **V-centering Key locks the Cutter Block**  **accurately and rigidly assuring dependable low cost operation of . . .**

McCROSKY *Block-Type* BORING BARS

Wide Range of *STOCK* Sizes

"*SPECIALS*" to meet any Requirement

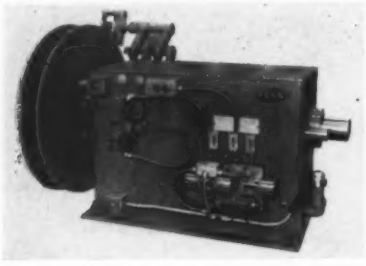
Many exclusive — and shop-proved — features, available only in our design, enable you to bore more pieces in shorter time with greater accuracy. High speed, cast alloy or carbide tipped blades, Standard Bars, with straight or tapered shanks, with or without pilots, for boring holes up to 15" in dia. "Specials" often combine several related boring, facing, counterboring and chamfering operations into a single tool, cutting costs and increasing production. Write for Bulletin No. 18-B.

COST CUTTING TOOLS **McCROSKY TOOL CORPORATION** MEADVILLE, PA.

Engineering and Sales Representatives in the Principal Cities

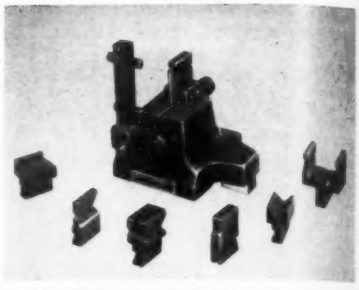
CIRCLE INFORM-A-GRAM KEY NO. 255

A New Line of Traversing Take-Up Reels to be used in combination with wire flattening mills has been



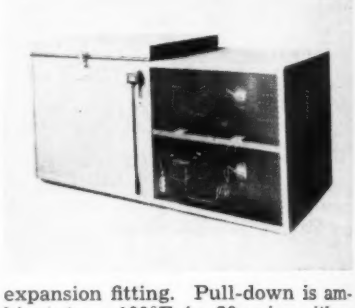
manufactured. Model 2310 (shown) is floor mounted and has a 3" dia spindle and a 10" stroke. Maximum weight of stock which can be coiled on this reel is 2,000 lbs. This type of reel is available in both larger and smaller sizes. Fenn Mfg. Co., Fenn Rd., Newington, Conn., or —
Circle Inform-A-Gram No. A87.

A Part-Holding Fixture for optical gaging has been developed by Optical Gaging Products, Inc., 26 Forbes St., Rochester 11. The Multi-Use Stage quickly clamps on work tables



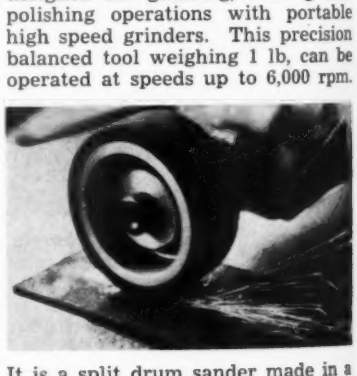
of standard models of all contour projectors and optical comparators. This device is suited to staging both cylindrical and non-cylindrical parts by means of several types of part holders in standard sizes (shown).
Circle Inform-A-Gram No. A88.

Greater Production Capacity and rapid pull-down are features of a new low temperature cabinet. Model WE-8-125 is designed for testing electronic components, stabilization of metals and thermal contraction and



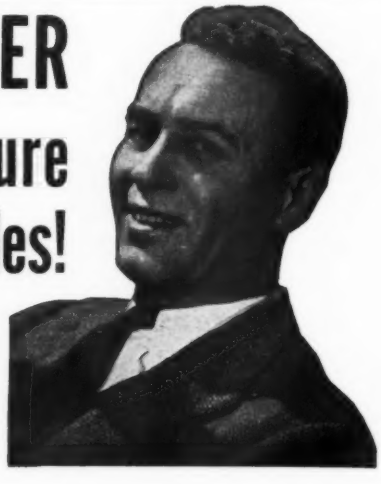
expansion fitting. Pull-down is ambient to —100°F in 30 min with a temperature range from ambient to —125°. Webber Engineering Corp., P. O. Box 217, Dept. 299, Indianapolis 6, or —
Circle Inform-A-Gram No. A89.

A 4" Dia Drum Sander has been designed for grinding, buffing and polishing operations with portable high speed grinders. This precision balanced tool weighing 1 lb, can be operated at speeds up to 6,000 rpm.

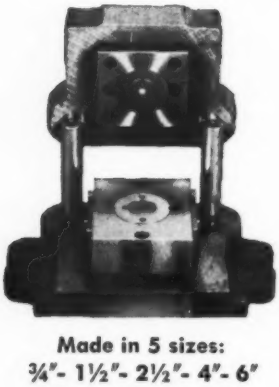


It is a split drum sander made in a 1½" width that will accommodate strips of coated abrasives torn off standard rolls. American Diamond Saw Sales, 120 N.W. 9th Ave., Portland 9, Ore., or —
Circle Inform-A-Gram No. A90.

"HOVIS WASHER DIES have sure solved our troubles!



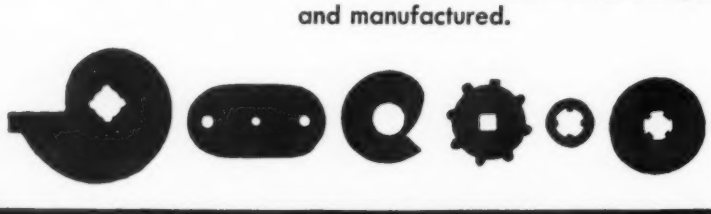
"You, too, should make washers the economical Hovis way. Save time, labor, materials and storage space"



Made in 5 sizes:
¾"- 1½"- 2½"- 4"- 6"
Write for Literature

NO NEED TO MAKE A NEW DIE FOR EVERY STAMPED PART

The modern method adopted by manufacturers nationally . . . These *Patented* Dies provide a Master Holder by which, upon simply and quickly removing and replacing Five, Small Interchangeable Parts, a new size washer may be produced . . . Special sets of parts available for use in these units . . . This method makes possible production of irregularly shaped pieces and shallow draws . . . Multi-Washer Dies designed and manufactured.

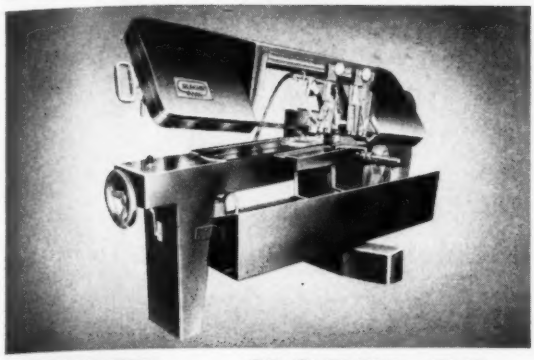


HOVIS SCREWLOCK COMPANY

8100 E. NINE MILE ROAD — VAN DYKE, MICHIGAN
Phone: Slocum 7-4800 — Suburb of Detroit

CIRCLE INFORM-A-GRAM KEY NO. 256

FIRST 8-INCH METAL CUTTING SAW TO MEET TODAY'S NEEDS



KALAMAZOO

MODEL 8C

cuts 8" round, 16" flat, 8" pipe

Instant-acting vise holds work-piece. Four speeds for best cutting. Accuracy easily controlled—blade action in cut easy to see. Blades changed in seconds. Automatic shut-off. All parts readily accessible. Ask your Kalamazoo dealer to demonstrate Model 8C.

Kalamazoo Metal Cutting Band Saw Machines:

KALAMATIC BAR FEED for Kalamazoo.

MODEL 1220 cuts 12" round, 20" flat.

MODEL 610 cuts 6" round, 10" flat.

MACHINE TOOL DIVISION

Kalamazoo TANK and SILO CO.

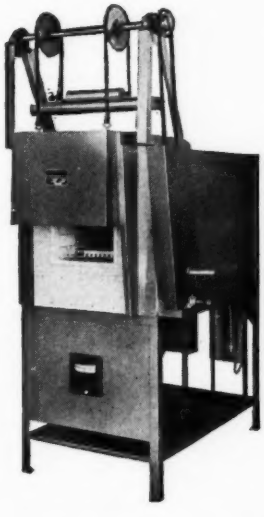
1570 HARRISON ST., KALAMAZOO, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 2571

"MULTI-INSULATION" is the secret of . . .

HUPPERT
Floor Model
FURNACES

These sturdy production type Huppert electric furnaces not only attain highest efficiency, but also cut operating costs to a minimum through the unique Huppert method of using multi-insulation surrounding all sides of the heating chamber. Heat range—continuous up to 1850° F., intermittent operation to 1950° F., can also be built for 2300° F. operation. This furnace comes complete with an indicating electronic temperature controller, and a tight seating, wedge-type door is used. Standardly furnished for 220 V. A.C. single or 3 phase operation. (110 V. or 440 V. models to order.)



This model built in 20 different sizes

Model No. 16 Illustrated 12"x8"x18"—$1014.00 complete

Write for literature on complete line of Huppert furnaces and ovens.

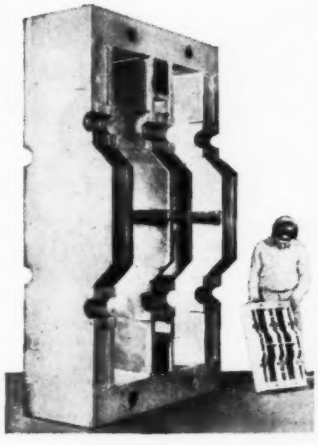
K. H. HUPPERT COMPANY

6820 Cottage Grove Avenue, Chicago 37, Illinois

Manufacturers of Electric Furnaces and Ovens

CIRCLE INFORM-A-GRAM KEY NO. 2572

WELDMENTS MAKE SENSE



Press Cap Weldment
(showing small scale pattern)

Weldments eliminate pattern costs and permit alteration without destroying the entire assembly. (Ideal for machinery use . . . change over).

•

Write for folder about our services and equipment for the production of Flat-Die Forgings — Weldments— Composite Die Sections and Plate Burning.

COMPOSITE FORGINGS, INC.

2300 W. JEFFERSON, DETROIT 16, MICH.

Phone TAshmoo 5-3226

CIRCLE INFORM-A-GRAM KEY NO. 2573

HELIOS
PRECISION DIAL CALIPER

Guaranteed Accuracy Within .001"
Reading .001"

- **SPEED**
- **PRECISION**
- **DEPENDABILITY**

6"
$31.80
F.O.B. New York

Full scale reading of 5" — 6" — 8" — 10" Available. Also Foot with Scriber to convert to Vernier Height Gage.

Ask for catalog and prices of other Standard Calipers.

NEISE MODERN TOOLS

KARL A. NEISE
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New York 16, N. Y.

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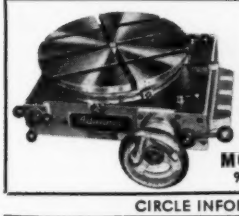


NEW Advance 15" Rotary Table has accuracy to within 30 seconds. This rugged piece of equipment is designed for all types of close tolerance work requiring rotational accuracy, with maximum speed and precision and minimum maintenance.

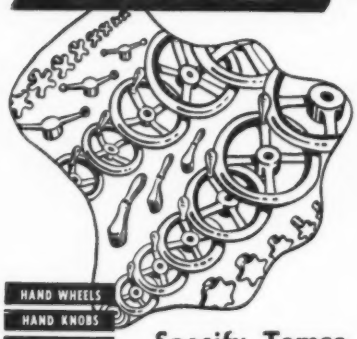
MORRISON ENGINEERING COMPANY
937 W. Lake St., Dept. A, Chicago 7, Ill.

CIRCLE INFORM-A-GRAM KEY NO. 2575

Complete Information about Metlfax Magazine Can Be Obtained By Writing To Dan Daniels, 1975 Lee Road, Cleveland, Ohio, Or —

CIRCLE INFORM-A-GRAM KEY NO. 2576

Tomco



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HAND KNOBS
MACHINE HANDLES
HANDLES
BALL HANDLES
SPECIALTIES

Specify Tomco for long lasting dependability

A complete line of high grade hand knobs, handles, and hand wheels is available from Tomco. Immediate shipments are made from stock of standard items. Specialty items are made to your specifications.

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Blank or Machined—from stock
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MACHINE SCREWS
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Star Stainless screws have clean—bright and—shiny—heads

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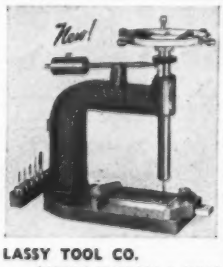
CIRCLE INFORM-A-GRAM KEY NO. 2582



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SUPERSENSITIVE HAND TAPPER

New exclusive features and top quality make Lassy Tappers outstandingly the finest available. Write for illustrated circular showing 3 models, and also Universal Tap and Die Guide.

LASSY TOOL CO. Plainville, Conn.
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SPEED

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(Gas-Fired)
HIGH SPEED
HEATING UNITS

- Use city gas and air — equipped with high speed burners.
- Handle *large* variety of sizes and shapes. Available with stationary or rotating holding fixtures.
- Production rates as high as 3,000 pieces per hour on small pieces.
- For further details on G.A.S. Turntable and Conveyor-Type Heating Units, *write for Bulletin No. 511.*

in Localized
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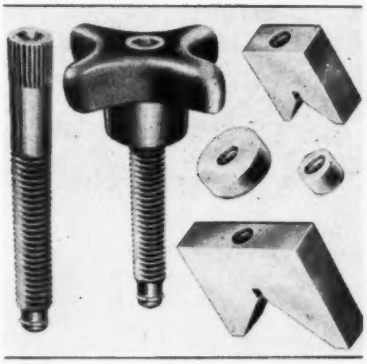

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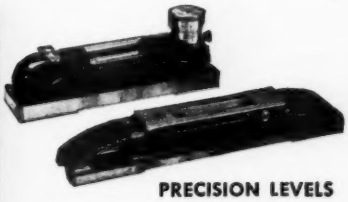

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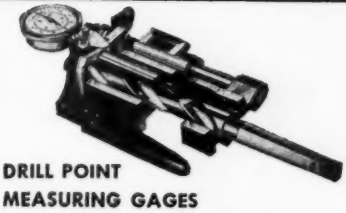

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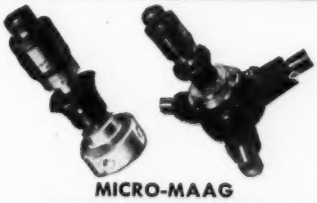

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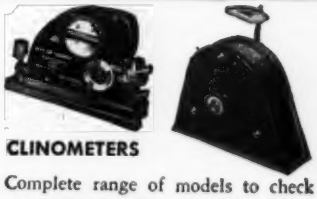

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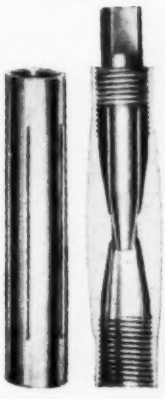

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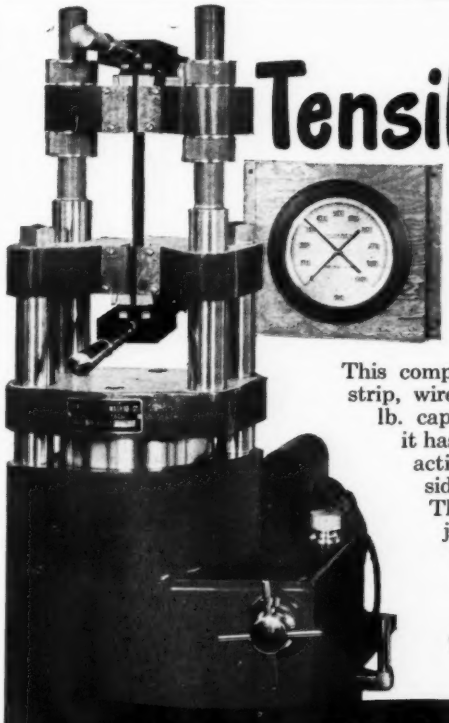

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CUMULATIVE EDITORIAL INDEX FOR 1957 ISSUES

TOOLING & PRODUCTION Magazine

The number of subjects on which T&P's editors present material in just a few issues adds up very rapidly. Most articles are of lasting interest and have future reference value in solving tooling and production problems.

This cumulative index will build up progressively during each calendar year. Each issue will carry a cumulative index of material contained in all previous issues of the same year, with each January issue carrying the complete index of the twelve issues of the previous year.

We suggest you see to it that your copies of T&P are retained for future reference so you can get the full benefit of this new, unique and useful index.

The Publisher

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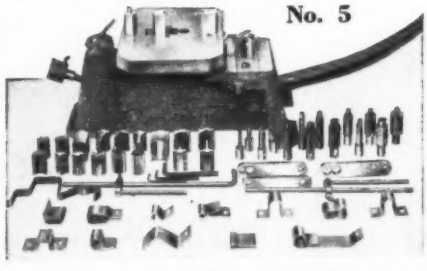

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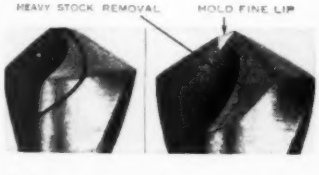
CIRCLE INFORM-A-GRAM KEY NO. 2622

Turn To Page 180 For Complete Information About "Die Designing And Estimating". For Information Regarding Metlfax Magazine Circle Number 2576 On The Inform-A-Gram Card Which Faces Page 220.

A GRINDING PROGRESS REPORT

Bay State Engineer Finds Way to Triple Production on Chisel Point Grinder

The special "chisel point" on a twist drill makes it start faster in hard materials. Grinding it in one cut and at production rates presents a difficult wheel selection problem, as shown.



For one manufacturer, neither wheels soft enough for the heavy cut nor those hard enough for the fine cutting of the lip could meet the production and quality standards. Expensive overtime shifts were being worked when Bay State was called in.

Bay State District Manager Bob Belmont saw, in this one operation, two grinding tasks so different that one set of wheel "specs" could not possibly do them both.

The "sandwich" wheel illustrated below, with two layers of different abrasives, was his answer. The hard (P grade), fine (220 grit) layer grinds the fine lip. The coarser (150 grit), softer (N grade) side does the heavy cutting.

Bob Belmont demonstrated capable engineering in action. He tripled production, reduced rejects, eliminated overtime, and lowered grinding costs.

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